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AUGUST 511

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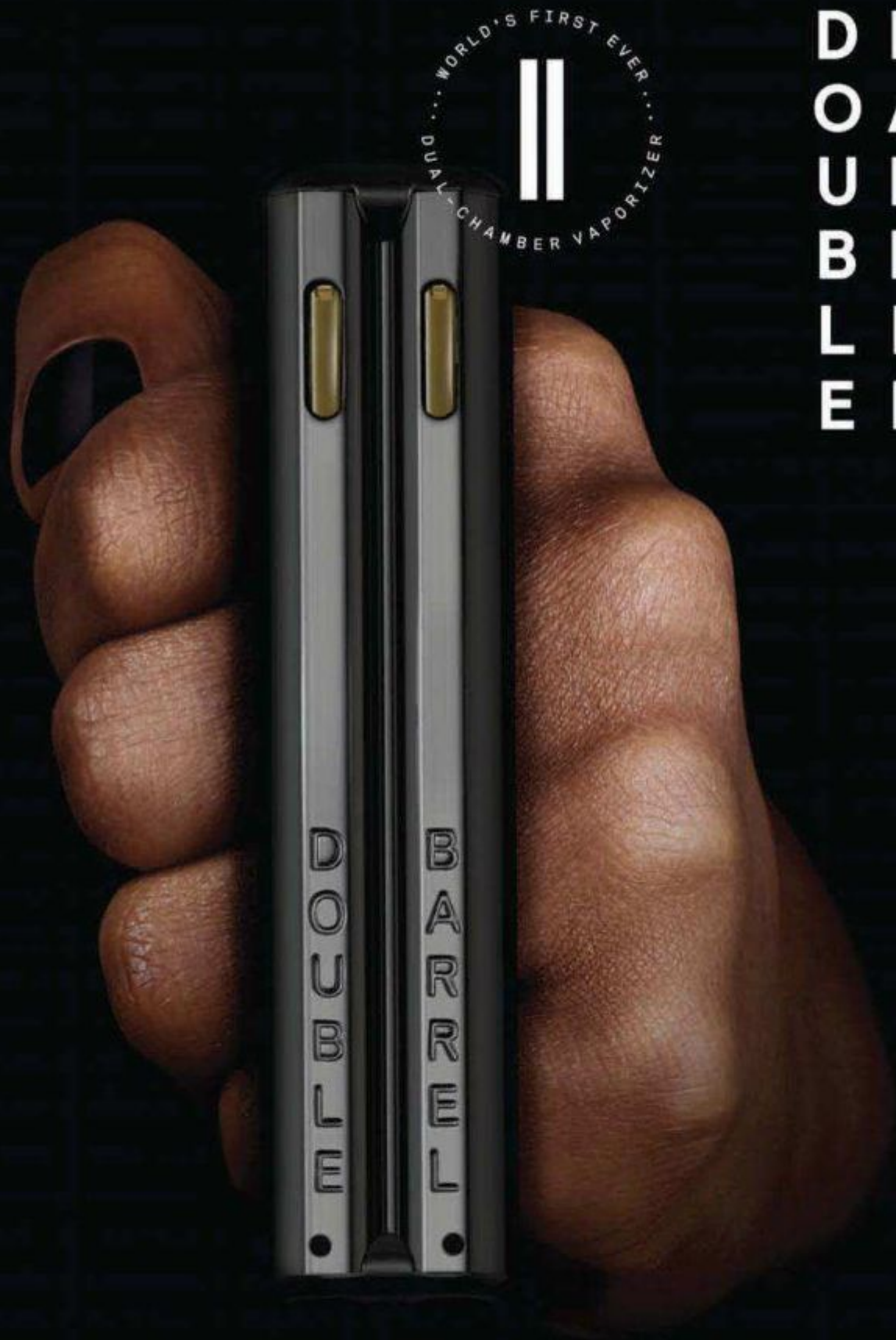
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HIGH TIMES AUGUST



“CANNABIS IS A PLANT THAT THRIVES WHEN GROWN OUTSIDE IN THE RIGHT ENVIRONMENT! IT PRODUCES AN AMAZING ARRAY OF TERPENES AND FLAVORS AND BEAUTIFUL FLOWERS.”

The Organic Terroir of Puffin Farm—page 66

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Take a tour of an outdoor Washington State “Mom ‘n’ Pop” grow op run by a conscientious couple seeking to produce clean and fragrant cannabis with a flavor all its own. *By David Goodman*

80 CANNABIS GENETICS: THE NOT-SO-BASICS OF BREEDING
We break down the difficult processes involved in creating the strains we want for medical and recreational purposes while explaining how feminized seeds do more harm than good. *By Nico Escondido*

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Legendary actor and counterculture icon Peter Fonda discusses the many benefits of cannabis and hemp and how activism can still effect change. *By Mike Gianakos*

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TOP 11 DRUGS IN SCI FI & FANTASY

By focusing on fictional universes, races and technology, the science fiction and fantasy genres are often able to present subversive social commentary that causes audiences to reconsider aspects of life in the real world. Thanks to the distance created by these alien worlds, observations on politics, war, drugs and more can be presented to an audience unencumbered by the baggage such topics carry in real life. With this in mind, *High Times* is taking a closer look at the top drugs in science fiction and fantasy. Whether it's William S. Burroughs's heroin stand-in "Black Meat" from *Naked Lunch*, the mysterious and violence-enabling milk (Moloko Plus) from Anthony Burgess's *A Clockwork Orange*, or Aldous Huxley's omnipresent panacea soma in *Brave New World* (which takes on new meaning given the current opioid crisis in America), these works provoke thought on real-life narcotics and the political and social dynamics surrounding them.

Few sci-fi works did social commentary better than *Star Trek*, which makes our list for its "Venus Drug" in Season One, Episode Six. Check out our "Top 11 Drugs in Science Fiction and Fantasy" list at hightimes.com.



WE WANT TO HEAR FROM YOU!

Tweet your best high observations and comments our way @HIGH_TIMES_Mag for a chance to be featured on this page! And be sure to follow us on Facebook: (Facebook/HighTimesMag) and Instagram: (@hightimesmagazine) for all the latest news as it's happening!

@CANNILIVE: @HIGH_TIMES_Mag Mild edible or tincture doses at work help me from being distracted by my pain. Takes the focus off of the problem and allows me to work unbothered and uninterrupted.

@1classicpothead: Gotta start from somewhere, I plan on being on the cover of @HIGH_TIMES_Mag...

@420IndianaChicc: @HIGH_TIMES_Mag Erry month I give 4 low income ppl w/ med issues-2 cancer, 1 fibromyalgia & 1 Vietnam Vet an oz of my personal. Good karma & marijuana is medicine.

@peaceloveemp: @HIGH_TIMES_Mag Daytime=joint Weekend=blunt Before bed=bowl Official weed breakdown

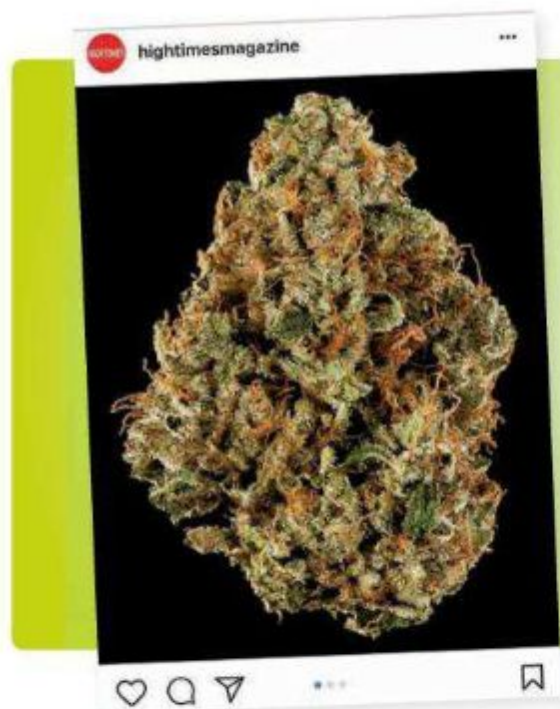
@drmicheleros: @JodieEmery @HIGH_TIMES_Mag Yes, this impacts not only cannabis but psilocybin movement, which I'm helping lead in Denver.

@ComOut4Cannabis: @HIGH_TIMES_Mag It will be significant when a place as deeply conservative as the Hoosier state re-legalizes. An indication the final push to worldwide freedom for the weed has begun. Your turn at bat, Indiana.

@19xxCovey: @HIGH_TIMES_Mag Oh my God yes if that could prevent me from taking let's see 25 to 30 pills per day and eliminate it all I'd be happy to do so every day of the week. Super sad that such a thought brings tears to my eyes!

@WilderShaw : Been doing some work for @HIGH_TIMES_Mag -- the first job I've ever had where I'm afraid to get caught NOT looking at weed on my computer

@dretinas: @HIGH_TIMES_Mag Black Afghani hash at the Great Pyramids of Egypt while serving in the US Navy 1980. Telly Savalas (the actor) pulled up in a limo when we were leaving.



ON INSTAGRAM

No matter what you're into—dabs, non-solvent hash, edibles, topicals, tinctures or CBD-heavy medicine—it all starts with the flower. The Cannabis Cup, now in its 31st year, started as a celebration of the flower. We continue that tradition and pay homage to one of our favorite flowers from the 2018 SoCal 420 Cup, XXX OG by Life is Good Healing. This XXX OG took first place in the *indica* category, beating out heady competition from Atrium (92 OG) and Garrison Lane (Billy Kimber OG). See all the winners from the 2018 SoCal Cup on page 54.

THE MANY USES FOR HEMP

Most people are aware of the incredible usefulness of hemp—it can be an environmentally conscious substitute for plastics and even concrete. It can curtail deforestation—an acre of hemp produces as much paper as four acres of trees and the crop is far more sustainable. It can be used to make clothing, rope, foods and much more.

The US has a fascinating history with hemp. Cannabis's cousin doesn't contain enough THC to get you high but hemp was still banned. Of course, its wide array of uses is the reason it was banned, as hemp stood to put industries out of business.

Given the incredible gains of the cannabis industry in America, it's odd that hemp lags behind—many other countries are embracing hemp as an environmentally sound and hugely profitable industry. So, we thought it was a good time to revisit some of the many uses for hemp. Head to hightimes.com and check out our "15 Products That Can be Made from Hemp."



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LEGALIZATION'S LEGACY

"An established herb becomes an heirloom, for in all likelihood, it will outlive the gardener who plants it."

—ELIZABETH LAWRENCE

AS MARIJUANA BECOMES more legal and mainstream, many fear a corporate takeover of the industry and a homogenization of the plant itself. Indeed, huge conglomerates are buying up anything weed-related at a steady pace and industrial pot-production facilities are getting larger and larger. That's why it's so important for our cannabis community to forge our own way into the future.

Only we can ensure that the cultivars we enjoy are preserved and grown with the proper care that they, and we, deserve. In this issue, we focus on a number of ways to make certain that marijuana in the modern age is not poorly manufactured. Instead of simply complaining about the industrialization of our favorite flower, we must seek alternatives, whether that means growing and breeding our own precious plants, purchasing from smaller co-ops and local farmers' collectives, or properly lab-testing all available products for pesticides, potency, mold and more.

To that end, we spotlight Puffin Farm, a mom-and-pop grow op in Washington State that focuses on cultivating clean outdoor cannabis with a natural terroir all its own. Our own Nico Escondido reveals the basics of breeding so that anyone can create their own stupendous strains without clouding the already murky gene pool. We also take an in-depth look into the veracity of lab testing to figure out if the results we've been getting from various facilities are accurate. Also, we take a look inside our recent 4/20 Cannabis Cup in Southern California and editor-in-chief Mike Gianakos holds a revealing interview with cinema and counterculture icon Peter Fonda.

So remember, the corporations need us more than we need them. We're faced with the task of making sure that future generations of marijuana consumers and patients have access to the highest-quality cannabis. Legalization and our favorite flower will indeed outlive us all. Our job, first and foremost, is to maintain our community and honor the plant.

Danny Danko
SENIOR CULTIVATION EDITOR

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MORE QUESTIONS THAN ANSWERS

I'm 26 years old have two kids. Though I may have a great life, I have been dealing with an eating and sleeping disorder since I was a kid and doctors can't do much. But when I started smoking pot, that helped. You would think that might be the end of the story but, living in the state of Georgia, pot is illegal. And because there is no official diagnosis for me, I don't qualify for CBD in GA. I'm curious about other people living with medical conditions in prohibition states; Does weed help? Does it being illegal affect their life? Are they getting access to meds?

*Alexandra
Atlanta, GA*

I WANT A LITER OF COLA!

Loved the *Super Troopers* interview in the June 2018 issue. Broken Lizard is great. But I was shocked to read that they wrote 30 something drafts of the movie. That's crazy! But very interesting. I also loved the idea of them taking turns reading all the characters until finally casting (which they ultimately did perfectly). Although I would like to see footage of Chandrasekhar playing Farva. If only it existed...

*Bill
Michigan*

Those guys are serious about being funny. And agreed, we'd like to see alternative Farva footage as well.

VET'S DILEMMA

I became an advocate for the recreational use of marijuana before I was hip to the fact that it has medicinal benefits. I mean sure I was always telling people about how it helped cancer patients with their pain management and helped them to regain their appetite, but honestly, I never knew it had so many medical properties.

Natural pain relief is one of the biggest benefits of medical marijuana. If you can use something natural and non-habit forming to help ease your pain from any number of diseases, then why would you use an opioid based pain pill? One that is not only highly addictive, but can also cause you to become constipated, screwing up your digestive system. Especially if you are someone already suffering with Crohn's disease? Or if you're like a buddy of mine that came home from serving his country with a case of PTSD and has trouble keeping anything in



WE HAVE THIS BEAUTIFUL PLANT THAT NOT ONLY HELPS MY FRIEND WITH MANAGING HIS PAIN, BUT ALSO INCREASES HIS APPETITE, BUT HE CAN'T USE IT BECAUSE IF HE DOES THEN THE VA WILL NO LONGER TREAT HIM.

his stomach, and if he does manage to keep some food or drink down it causes him incredible pain. The VA doctors are hesitant to prescribe veterans any form of pain medication because they've become so jaded from people trying to scam drugs from them because they became addicted to the pain-killing drugs they prescribed to them in the first place. And yet we have this beautiful plant that not only helps my friend with managing his pain, but also increases his appetite, but he can't use it because if he does then the VA will no longer treat him.

D.

KNOW YOUR RIGHTS

I just finished reading your highly-anticipated "Driving High" article in my newly received April 2018 issue. Although I agree that it is good for the cannabis community and law enforcement to "gain a better understanding of each other," I also would like to point out that it is important to know your rights while still being respectful when dealing with law enforcement. I feel this article glossed over that topic a little bit.

Law enforcement cannot force you to submit to a blood test unless you are

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involved in a serious car accident. Getting pulled over on a routine traffic stop and being forced to take a blood test is not [going to happen]. However, it is something that some police will routinely lie to people about in order to intimidate them.

*Nelson
Florida*

TIME MAKES FOOLS OF US ALL

I recently found myself at some marijuana club in Anaheim. I was smoking and thinking about my younger brother who told me years ago that marijuana will never be legal in our lifetime. That's one case he would have lost.

I was sitting there smoking and thinking about all my friends over the years who've gone to prison for pot. People who lost everything—and some who made it good. All those years in the black market. As I write this it makes me laugh to think marijuana was ever illegal.

*Mike
California*

The progress has been remarkable. But remember that it's not legal for everyone yet. There are still Americans going to jail and having their lives destroyed over cannabis. Here's hoping that someday we can all laugh at the notion that pot was ever illegal in this country.

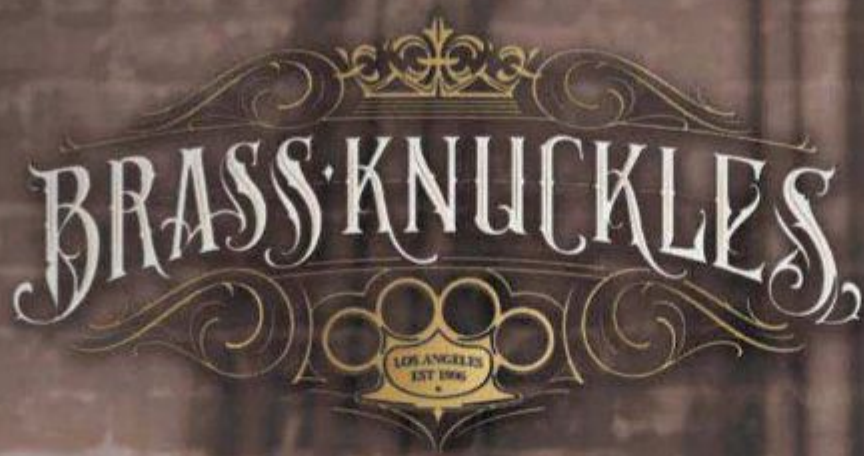
PONDERING POT

The state of marijuana in the United States is interesting. A Schedule I classification makes its possession, sale and use illegal by federal law. At the same time, a notable number of states have legalized cannabis. Another element of the marijuana apparatus that has advanced alongside unfriendly policy is scientific research. As a result, a science of cannabis has evolved alongside state experience.

Perhaps the most interesting thing about pot is individual thought, character, and art—what one might consider the *internal*—as positively influenced by cannabis. Philosophers, presidents, leaders, scholars and various content creators have been productively effected by this psychoactive product.

Pot influences the internal but understanding its signification requires a *serious* paradigm shift.

Juan Velez





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THE NIGHT BEGINS TO SHINE An evening look at Puffin Farm, a family-owned and operated outdoor organic marijuana orchard in Washington State. Learn about their procedures and techniques for achieving terroir—the unique characteristics of flavors and aromas imparted by natural soil and environment on page 66. *Photo by Cliff Goodman*





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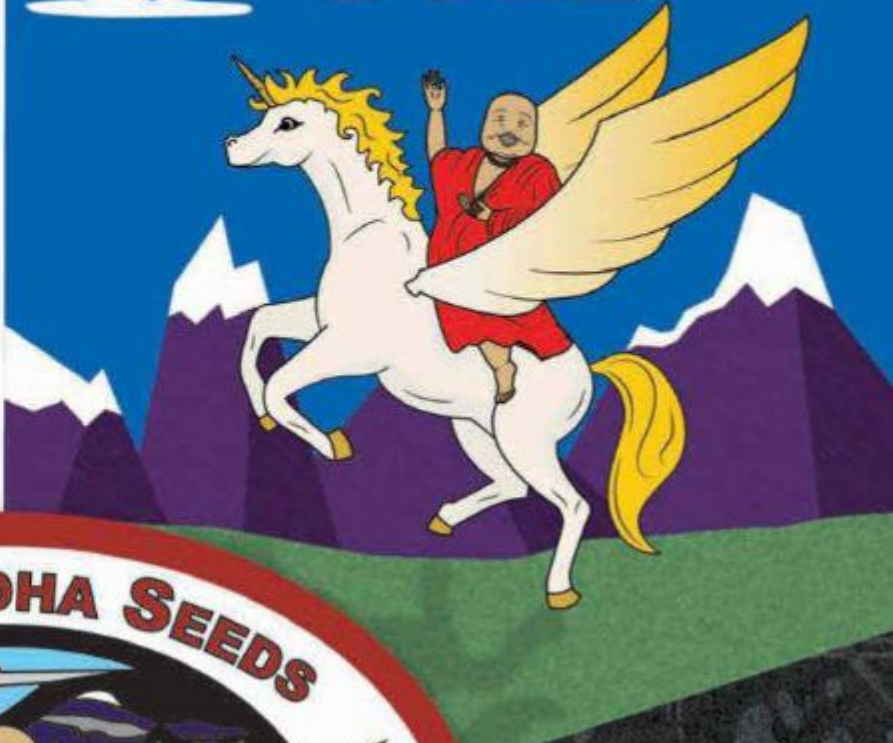
ALL IN THE FAMILY Creating seeds is not that difficult to do. In fact, it can even happen by accident. But creating stable, true-breeding seeds of desired traits is actually difficult. And to do it without feminization that can ruin the cannabis gene pool? Well, that takes actual skill and smarts. Find out why on page 80. *Photo by Mel Frank*



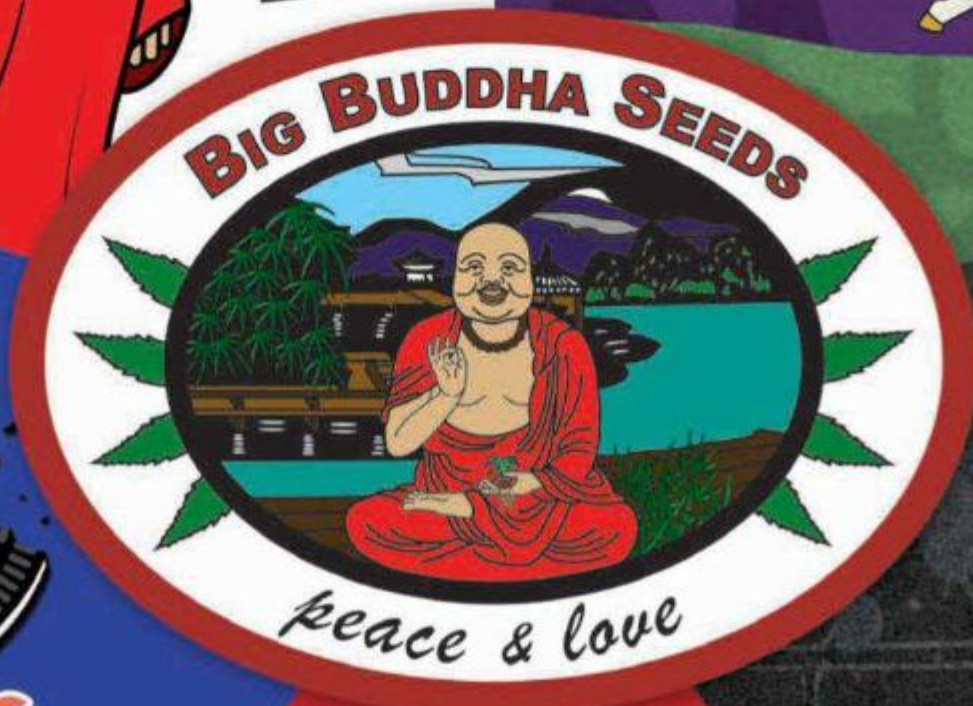
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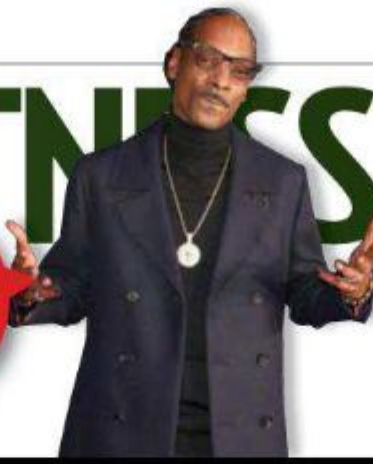
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NEWS

MARIJUANA MICE

Cops in Argentina blame mice for 1,000 pounds of missing pot seized by the department. p.26



ENTERTAINMENT

GEORGE CLINTON

The high priest of funk keeps the hits coming now that he's replaced crack with cannabis. p.34



Willie Nelson
and Snoop Dogg
are the new
high-witnesses



Sign of the times

results is a mishmash of intrastate regulations.

The *Orange County Register* recently traced a morning commute that began in strict Irvine, where all commercial-related cannabis activity is prohibited, and ended in permissive Los Angeles, where one can enjoy every type of cannabis business under the sun. In between, the commuter passes through Santa Ana (retail sales allowed, but not commercial cultivation), Lynwood (commercial grows yes, pot shops no), Fountain Valley (backyard gardens good) and Montebello, “which requires permits if people want to grow one plant inside a locked room of their home.”

Colorado is not

immune to this schizoid dynamic either. Most of the state's 64 counties have actually banned weed production and sales, although incorporated townships within a banned county can still go green if they choose. And so we find odd “borders,” such as 25th Street, which divides tiny Garden City—home to four rec-pot businesses—from Greeley, which has none.

The state of New York is currently studying the impacts that the bordering states of New Jersey and Massachusetts, each in varying stages toward legalization, will have on it. Depending on whom you ask, the Empire State is either laying the groundwork for its own legal regime down the road or paying lip service to the same.

Within Massachusetts itself, border towns can expect plenty of traffic from non-legal states. The small city

BORDERING ON SUCCESS

LOCAL GOVERNMENTS—STATES, COUNTIES, TOWNSHIPS—ARE GENERALLY GIVEN CONTROL OVER CANNABIS POLICY. WHEN LEGALIZED REGIMES SIT NEXT TO PROHIBITIONIST ONES, THERE ARE WINNERS AND LOSERS. BY MIKE DIPAOLA

MARIJUANA LAWS IN the United States are a patchwork of diverse and often conflicting regulations and rules. Border areas that separate one jurisdiction from another are affected by these disparities, but we're only just beginning to understand how these dynamics play out.

There are all kinds of borders, from the imaginary lines that distinguish weed-dealing counties from their prohibitionist neighbors, to the continent-wide frontier between green Canada and

its comparatively puritanical neighbor to the south that will soon delineate legal cannabis access.

California has legalized weed at last, but in order to achieve that policy success, the state had to grant local jurisdictions the freedom to set their own policies. Many have just said no to weed: Only 144 Golden State cities (out of 482) allow any kind of cannabis business; just 18 counties (out of 58) permit cannabusiness in their unincorporated areas. What

« of Attleboro, for one, has plans to grant licenses to at least five shops in order to fully cash in on cross-border traffic, much of it coming from Providence, RI, just minutes away. “I don’t have an upper limit as to how many [pot shops] would be a problem,” Mayor Paul Heroux told the *Providence Journal*. “We want the revenues. Very simple. It’s all about the revenues.”

There are, of course, international borders as well. Northern US states from coast to coast will get a contact high from soon-to-be-legal Canada, but it is unclear what those effects will be. One near-certain impact will be longer waiting times at the border, according to a recent report issued by the Canada Border Services Agency. “Unless exemptions are made for personal amounts of marijuana,” the report states, “cannabis legalization may increase workloads for officers and translate into longer border wait times, particularly at land borders.”

Within Canada, there are border distinctions to be made as well, since each of the 13 provinces and territories are setting their own regs for the coming legal market. Most will declare the minimum age for purchase at 19, for

ANYONE TRAVELING TO (AND WITHIN) THE GREAT WHITE NORTH WOULD BE WISE TO CHECK ON APPLICABLE LOCAL LAWS. MEXICO, MEANWHILE, IS ALREADY FEELING THE BUZZ FROM ITS GRINGO NEIGHBORS.

example, but Alberta and Quebec will allow 18-year-olds in on the fun. Most of the provinces will allow home grows of up to four plants—except Manitoba and Quebec, which won’t allow any. Anyone traveling to (and within) the Great White North would be wise to check on applicable local laws.

Mexico, meanwhile, is already feeling the buzz from its gringo neighbors. Tourism Minister Enrique de la Madrid recently said it was dumb for Mexico to maintain its prohibitionist laws with the United States going in the other direction. “I think in Mexico we should move towards regulating it at state level,” he declared recently, calling it “illogical” to use its limited law-enforcement resources on marijuana crimes.

On the US side of the southern border, states with legal markets have seen a drop in violent crimes. According to a recent study published in the *Economic*

Journal, the cool states have seen crime drop by an average of 13 percent since cannabis was legalized, with even higher rates of decline for homicides. “These laws allow local farmers to grow marijuana that can then be sold to dispensaries where it is sold legally,” said Evelina Gavrilova, one of the study’s authors. “Whenever there is a medical marijuana law we observe that crime at the border decreases because suddenly there is a lot less smuggling and a lot less violence associated with that.”

What we are learning from borders is that legal jurisdictions are winning: in economic growth, tax-revenue boosts and, not least of all, freedom. Meanwhile, the rationale of prohibitionist towns, such as the fear of increased crime, has not come to pass. Maybe the best solution would be to make herb legal everywhere, dispensing with the idea of borders entirely.

HIGH FIVE

JUST ADD POT!

OUT-OF-THE-BOX ENTREPRENEURS IN THE CANNABIS INDUSTRY. BY FRANK GREGORY



GANJA-FUELED YOGA
Dee Dussault, a hatha-yoga instructor for 22 years, conducts these biweekly classes in an art gallery in San Francisco’s SoMa (south of Market Street) district. Dussault explains that combining cannabis use with the yoga poses helps students redirect themselves from racing thoughts and pain points while nurturing mindfulness of body movement. The group smokes a joint together before beginning the yoga exercises, and students can smoke as desired between poses. The weed is free, since California’s Proposition 64 makes gifting up to an ounce of pot legal.



CANNABIS PAINTING CLASS
Known as Puff, Pass and Paint, these classes were founded by Heidi Keyes, an artist and cannabis user. They began in Denver after Colorado legalized cannabis, and the practice has expanded to six states where marijuana is now legal. The two-hour class is BYOW (bring your own weed), however, sponsors often provide product to sample. The workshop offers a baseline project to start off. However, creativity is encouraged and folks do their own thing. Invariably, joints are passed during the session, and participants often take in the work of others.



CANNABIS BIKING TOURS
Bike tours are one form of “cannatourism” gaining popularity in legal-pot states. Tours provide fitness, education and socialization at every turn. Community cohesion arises as local merchants join together for a positive tourist experience. Bike tours have also become a solid means to raise money for the medical-cannabis cause. Typically, these tours, guided or self-guided, take you through locales and provide a local history of marijuana-legalization efforts, with stops at dispensaries for product sampling, glass shops, snack stops and other points of interest.



DISPENSARY DESIGN
Megan Stone was introduced to cannabis retail dispensaries as a medical-pot patient. She worked as a budtender while attending school for interior design. After graduating, she started her own business. Her mission was to create eloquent retail spaces for her clients, elevating the industry by promoting professional design. Often, she goes beyond physical design, assisting in developing a brand, logo and imaging for her clients. Her Phoenix-based business has designed retail spaces for more than two dozen dispensaries across 13 states.



CANNABIS FLORIST
Bec Koop of Centennial, CO, never planned to incorporate cannabis into her floristry business, Buds and Blossoms. However, it soon occurred to her that there are clients who would like weed added to their floral arrangements for later consumption. Now Koop artfully tucks pot around floral sprays. The marijuana itself is selected and paid for by the clients. In Colorado, the florist must be sure not to carry (or inventory) more than the state’s legal limit. Furthermore, clients must legally purchase the weed and provide the florist with a receipt as proof.



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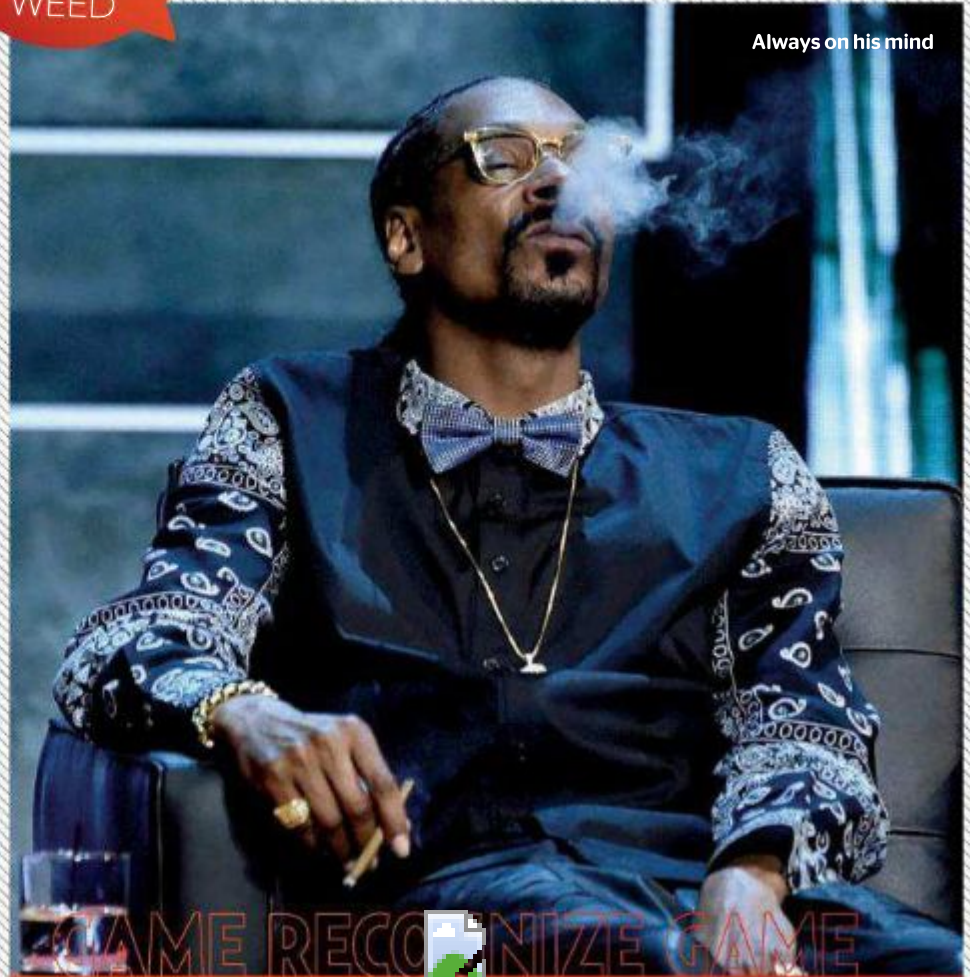
The mouse that scored

MIGHTY MICE

Police in Pilar, Argentina, were put on the spot when about 1,000 pounds of confiscated pot went missing. The city's former police commissioner, Javier Specia, who had left his post in April 2017, had to explain the missing weed before a judge, according to the *Guardian*. Specia and three of his subordinates claimed the weed must have been "eaten by mice." A merciful judge might have just laughed at the excuse, but this court brought in forensic experts to testify that the little rodents could not possibly have scarfed so much cannabis. "Buenos Aires University experts have explained that mice wouldn't mistake the drug for food, and that if a large group of mice had eaten it, a lot of corpses would have been found in the warehouse," a spokesperson for the judge said. The four cops must testify again before the judge, who will decide if the disappeared ganja was the result of "expedience or negligence."

CANNA SEWERS

Canada is about to deploy a novel way to measure how much weed the populace consumes: by administering drug tests to the sewers. To be more precise, the government agency responsible for gathering data on the coming legal pot market, Statistics Canada, has said it will be using "wastewater analysis to measure drug consumption levels in the general population." This methodology for gathering info has a number of things going for it: It's relatively cheap, there's zero burden placed on businesses or households, and there are no breaches of privacy or confidentiality. Besides screening for cheeba, the stats folks will also be monitoring the levels of opioids in the wastewater and will store samples in case they wish to make "retroactive analysis for other drugs and metabolites." If the agency can develop robust baseline information at the municipal level, policymakers will be able to assess the impacts of legalization as it unfolds, toward the end of the summer.



Always on his mind

"By the way, Willie Nelson is the only person who's ever out-smoked Snoop Dogg." Thus spake Snoop Dogg himself, in a discussion on who belongs on the "Mount Rushmore of Pot" with late-night TV host Jimmy Kimmel. "I had to hit the time-out button," Snoop added, something he says he's never had to do before. This was not Snoop's first hat tip to the legendary country crooner. Last year, he bowed before Nelson in an interview with *Vibe*. "That's the only person that's ever smoked me under the table," Snoop said then. And what are the telltale signs of being out-smoked? "When you want to stop," Snoop said. "When you are looking for an exit. You understand me? There is a rotation that's going around like a track meet. Then all of a sudden somebody passes you the baton and you're like, 'I'mma stand over here while y'all run that shit out.'"

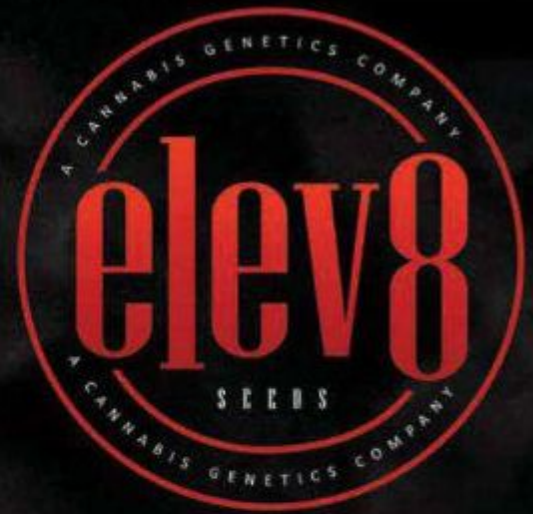


Follow the money.

BOEHNER TURNING GREEN?

John Boehner, the former Republican speaker of the house, has joined the green revolution. The guy who once said he was "unalterably opposed" to legalization has altered that position to join the advisory board of Acreage Holdings, an investment company that boasts "the most diverse portfolio of any company in the American cannabis industry, with cultivation, processing and dispensing operations across 11 states with plans to expand." Boehner will be joined on the board by a former Massachusetts governor, libertarian Bill Weld. The two issued a joint statement, and by "joint" we mean they both signed their names to it: "Over the past 20 years a growing number of states have experimented with their right to offer cannabis programs under the protection of the 10th amendment. During that period... the public perception of cannabis has dramatically shifted, with 94% of Americans currently in favor of some type of access, a shift driven by increased awareness of marijuana's many medical applications."

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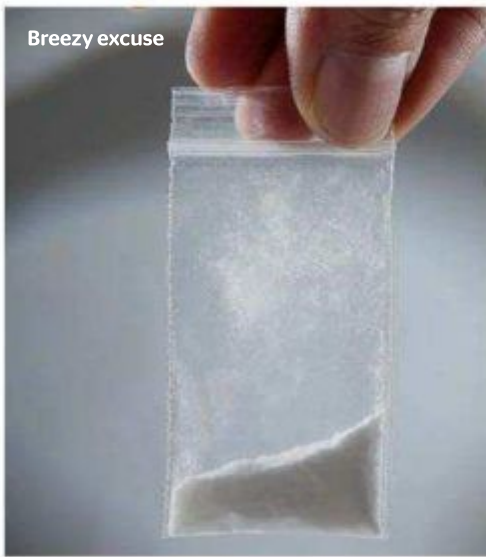
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Breezy excuse

AN ILL WIND

You get pulled over by a cop who notices that your ride is rank with the dank. In the ensuing search, he finds your weed and worse, your bag of coke. What to do? If you're 26-year-old Florida woman Kennecia Posey, you blame it on meteorology. "I don't know anything about any cocaine," she told the cop, according to Miami TV station WPLG. "It must have flown through the window and into my purse." Her explanation for the mysterious bag of coke in her possession was duly recorded in the Fort Pierce police report. Nevertheless, Posey was still detained in county jail, charged with coke and weed possession, a felony and misdemeanor respectively, and released after posting bail. Syndicated radio host Lenard McKelvey, a.k.a. Charlamagne tha God, gave Posey his "Donkey of the Day" award, which probably won't be used as a character endorsement when she has her day in court.

OREGON TRAILBLAZING

In 2016, the small conservative town of Turner, OR, legalized weed—by mistake. According to a report by the *Intercept*, the townsfolk (who had resoundingly voted against legalization in 2014 when the rest of the state went green) were confused by the wording of ballot questions. Turner residents were supposed to vote "no" if they wanted to ban cannabis businesses in Marion County, but then vote "yes" if they wanted to keep their city ban. As a result, 63 percent voted to kibosh the weed biz in unincorporated parts of Marion, but 51 percent said it was okay for Turner. Now the first pot shop in Turner is about to open. Voters might get the chance to undo their mistake with another ballot initiative in 2018. Hopefully by then the town's newly opened pot shop will have convinced enough of the constituency to realize they hadn't made a mistake at all.



Housing crisis

Federal agents swooped across Northern California recently in dramatic raids, targeting around 100 houses that were being used for illegal grow ops. More than 500 federal, state and local agents busted into houses around Sacramento, culminating an investigation that began in 2014. US Attorney McGregor Scott, a Trump appointee and erstwhile Bush appointee to the same post in NorCal's Eastern District, told the *Sacramento Bee* that the busts were not part of any plan to crack down on legal cannabis. "It absolutely has nothing to do with that," Scott said. "This is illegal under anybody's law." Rather, the raids targeted houses purchased by Chinese nationals believed to be part of a crime syndicate. Besides the homes seized, the raiders confiscated more than 61,000 plants, 440 pounds of processed cheeba, at least \$100,000 in cash and more than a dozen firearms. No arrests were immediately reported.



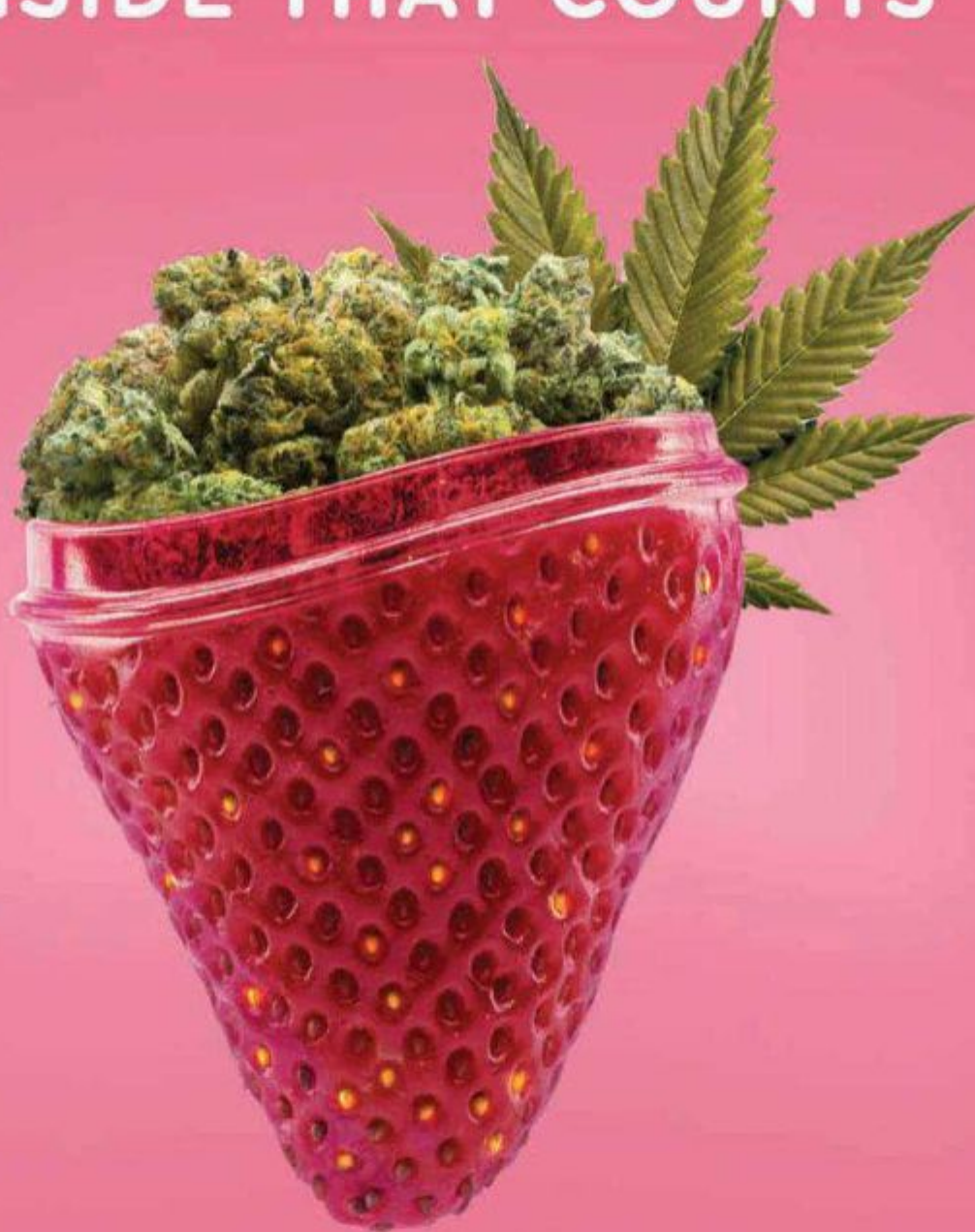
Digitize it.

NEW TECH ON THE BLOCK

Blockchain technology is finding a useful place in the weed industry. Blockchain—essentially a public, decentralized record of transactions that can't be deleted or altered—can help cannabis businesses with such weighty issues as banking or seed-to-sale tracking. Because so many weed businesses are forced to use cash-only transactions, the creation of a blockchain cryptocurrency for the industry was perhaps inevitable. Enter PotCoin, which claims to be "the first digital currency created to facilitate transactions within the legalized cannabis industry." *Lift* recently reported on the dank cryptocurrency and other blockchain-backed companies, including Smoke Network ("the world's first blockchain social network for cannabis users"), CannaSOS and Paragon. If blockchain sinks its links deeply enough into the pot industry, and it proves to be as effective in verifying transactions as its ardent fan base believes it to be, it could remain in place even if and when conventional banking becomes available for the cannabis industry. For now, it can only grow.

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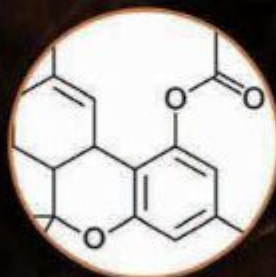
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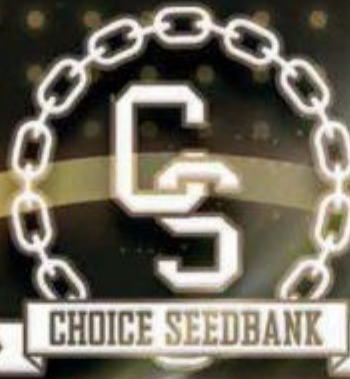


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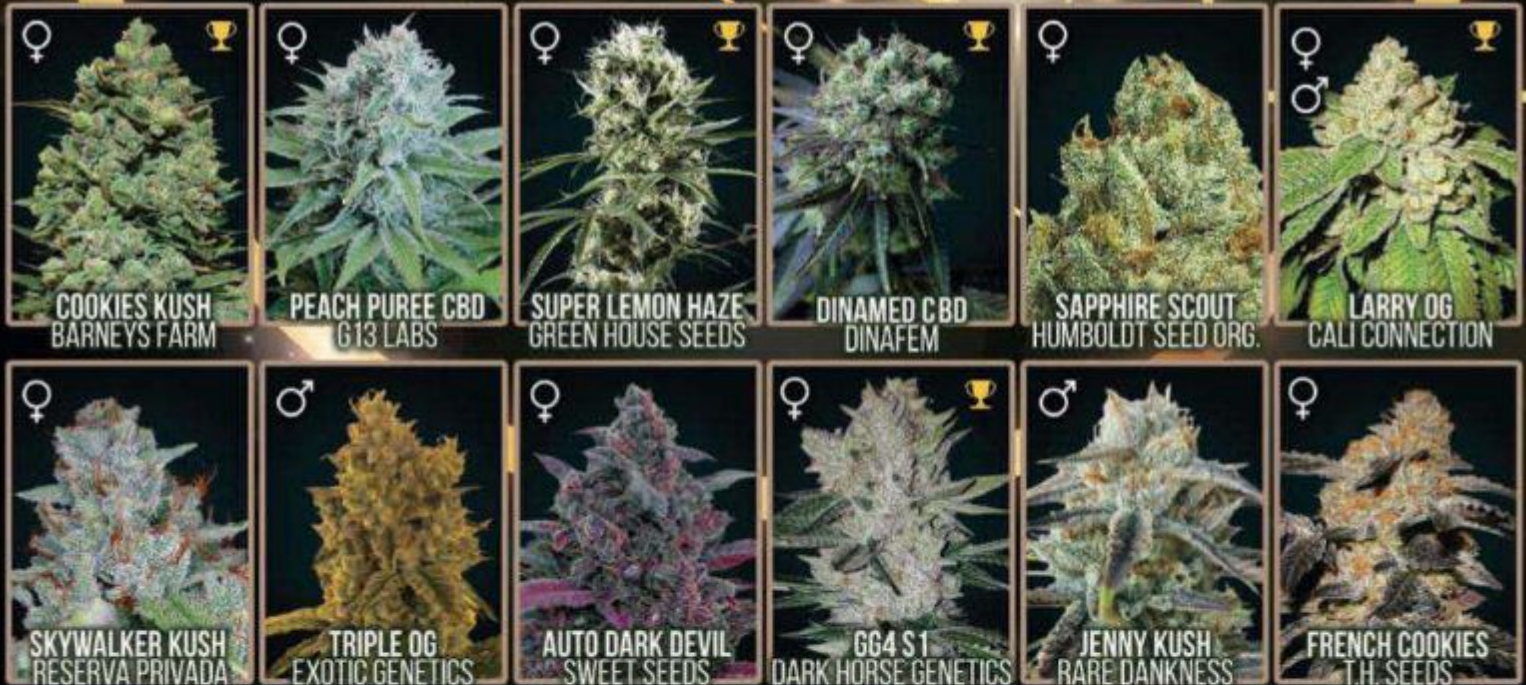
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PUFF, PUFF, PASSING

BASSIST THUNDERCAT REVEALS HIS RELATIONSHIP WITH WEED AND WHY WATCHING PEOPLE TRY TO SMOKE WITH SNOOP DOGG IS LIKE THE BEST SITCOM EVER. BY KYLE EUSTICE

FOR THE PAST 10 YEARS, prodigious bassist Stephen “Thundercat” Bruner has lent his otherworldly talents to albums from prolific artists like Erykah Badu, Kendrick Lamar and experimental producer Flying Lotus. His most recent solo album, 2017’s *Drunk*, soared with symphonic, jazz-influenced ballads and a helping hand from classic-rock icons like Kenny Loggins.

Although the Los Angeles native can count on one hand how many times he’s smoked cannabis throughout his 32 years, on the few occasions he has, it’s led to unforgettable moments.

“The first time me and Flying Lotus met, I had a moment with him where we kind of shared in each other’s worlds. It was never really a big thing for me, but I would see my friends dive into that world. I would just kind of watch ‘em. Watching somebody high is like a really good TV show,” Thundercat explains. “I think it’s fantastic.”

Flying Lotus, who enlisted Thundercat to play on five of his albums, quickly realized he couldn’t hang. In fact, he vowed never to smoke with him again.

“I don’t know what I did,” Thundercat admits, laughing. “He told me I was hitting my teeth with a butter knife because

I said my teeth were itching. He thought I was going to knock my teeth out with a metal utensil. He’s like, ‘Maybe you should never smoke.’”

Another memorable moment came when he was on tour with Snoop Dogg, and—as everyone knows—the Long Beach rapper doesn’t play when it comes to smoking.

“It was funny watching

“I WOULD WATCH PEOPLE JUST DIE IN THE TRENCHES IN THE MIDDLE OF THE DAY. THEY’D BE LIKE, ‘WHAT HAPPENED?’ WELL, YOU TRIED TO SMOKE WITH SNOOP. THAT’S WHAT HAPPENED.”

[people] try to smoke with him,” Thundercat explains. “From what I can remember—and I’m pretty sure he still smokes the same way—but years ago, it was like if you were in the studio, there would be at least seven to 10 blunts lit.

“Most people are used to just puff, puff, pass, but if you don’t realize you’ve been puff, puff, passing with like seven to 10 people, it gets ugly,” he adds. “I would watch people just die in the trenches in the middle of the day. They’d be like, ‘What happened?’ Well, you tried to smoke with Snoop. That’s what happened. It was like watching the best sitcom ever.”

That’s an apt simile for an artist who finds humor in everything and initially took the Thundercat moniker because of his obsession with the ‘80s cartoon (when he was a child, his mother was legitimately concerned about his borderline obsession with *ThunderCats*).

Despite the sophistication of his music, fans don’t have to look too far to discover Thundercat’s penchant for comedy. Some of the song titles and lyrics on *Drunk* border on the absurd. From tracks like “Captain Stupido” to hooks like “Bitch don’t kill my vibe,” he doesn’t shy away from the irreverent in his songwriting.

“Honestly, it’s always a good, healthy balance how everything functions,” Thundercat says. “The big important thing is being able to laugh.” ✨



COOL CAT

Thundercat is coming off his first late-night television performance on *The Tonight Show Starring Jimmy Fallon*, where he took the stage with Michael McDonald of Doobie Brothers fame and Kenny Loggins, who both appear on his solo album *Drunk*.

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George Clinton
soldiers on.

NOT GIVING UP THE FUNK

GEORGE CLINTON RECONVENES PARLIAMENT IN A BID FOR RENEWED RELEVANCE. BY CHRIS PARKER

IF INFLUENCE WERE RICHES, George Clinton would be Bill Gates. The 76-year-old funk legend bridged soul to rock like James Brown in the late '60s, then took the Day-Glo psychedelic exit ramp.

Performing (primarily) as Parliament and Funkadelic, Clinton and his rotating cast of collaborators pushed old-school Motown production values in new directions, donning Broadway-worthy stage costumes and employing arena-rock props like the signature Mothership, now housed at the Smithsonian National Museum of African American History and Culture in Washington, DC.

Yet Clinton's career was nearly derailed by a wayward counterfeiting scheme. But, he says, chuckling, "the funk had our back. Because we had been really good to the neighborhood, they came in and warned us."

Clinton came across the

forged bills while working at a neighborhood barbershop in Plainfield, NJ. He enlisted his friends in passing the funny money, which they went to great lengths to make appear used and grubby. They even wallpapered parts of the barbershop with it until a cop came in one morning.

"He didn't even look at the wall, he just said if I knew anybody that was doing anything like that I'd tell them they were onto 'em," Clinton recalls. "I cleaned my act up pretty good. I didn't want to take no more chances. That was so close."

A few months later, the Parliaments (as they were then called) got their first big break with the 1967 soul single "(I Wanna) Testify." But chasing singles was hard, and the band was imbibing the spirit of the time.

"We realized the groups we liked did albums—Cream, Beatles, Pink Floyd, jazz and

gospel groups," says Clinton. "The album was the thing. So we said we would go and find our thing and it was going to be 'Music for My Mother.'"

That was Funkadelic's first 45, featured on the group's 1970 self-titled debut album. The single referred to Lightnin' Hopkins and Muddy Waters, blues musicians whom Clinton's mother loved, and which formed the template for Clinton's new sound.

"It was going to be mid-tempo blues, not blues slow, and not fast as rock'n'roll, but mid-tempo, which was basically New Orleans and Motown," Clinton says. "We turned the volume up on it like Jimi Hendrix and commenced to funkng."



THE MOTHERSHIP?

Bootsy Collins and George Clinton may have encountered a real mothership during a drive in which they experienced missing time. When they arrived, Clinton recalls, "My brother walked out to the car and [said], 'Y'all look like you seen a ghost.'"

"WHEN I FINALLY STOPPED SMOKING CRACK AND STARTED SMOKING WEED, I [THOUGHT], 'I DONE WASTED MY TIME AND MY MONEY.' I REALIZED I SHOULD'VE BEEN SMOKING WEED ALL ALONG, BECAUSE THAT'S THE HIGH I WAS LOOKING FOR."

It's been a great run of nearly 50 years and more than two dozen studio albums for Clinton, although, much like the Godfather of Soul, he regrets his wayward mid-career affair with crack.

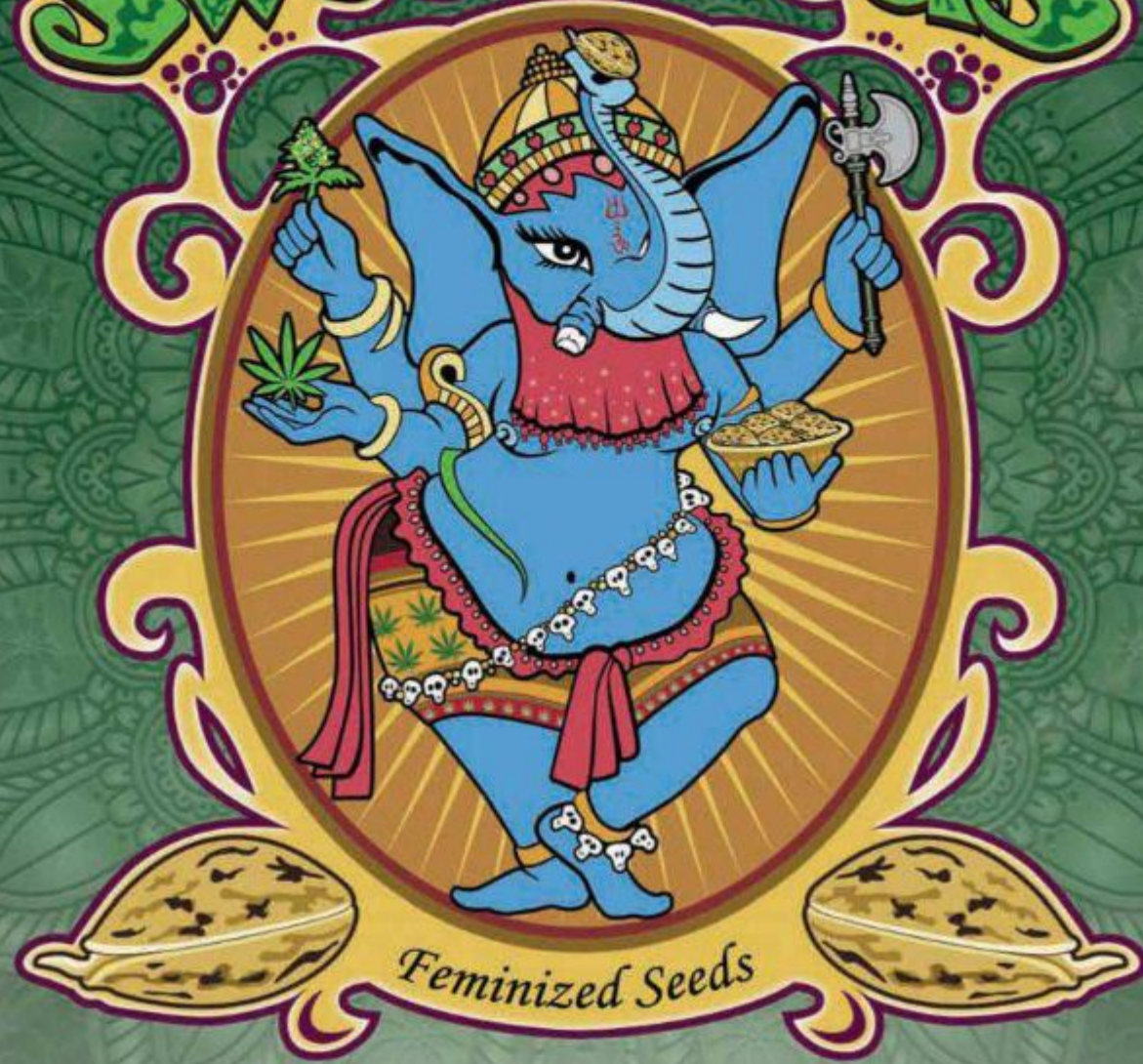
"When I finally stopped smoking crack and started smoking weed, I [thought], 'I done wasted my time and my money,'" Clinton says between draws. "I realized I should've been smoking weed all along, because that's the high I was looking for. Nobody told me it was going to be chronic and shit."

Recent collaborations with Scarface, Childish Gambino and Kendrick Lamar are consistent with the forward-looking aesthetic that found Clinton befriending Afrika Bambaataa, Big Boi and Dr. Dre before they were superstars. Always dialed in, his musical taste has aged like fine wine.

Now he's following the 2014 release of the first new Funkadelic album in 33 years with the first new Parliament disc in 38 years. Clinton is back on the road and in the stores with a new generation of relatives and extended band family. He's already in the Smithsonian and the Rock & Roll Hall of Fame. There aren't many milestones left.

"All that's left," Clinton says, "is to get some money." ✨

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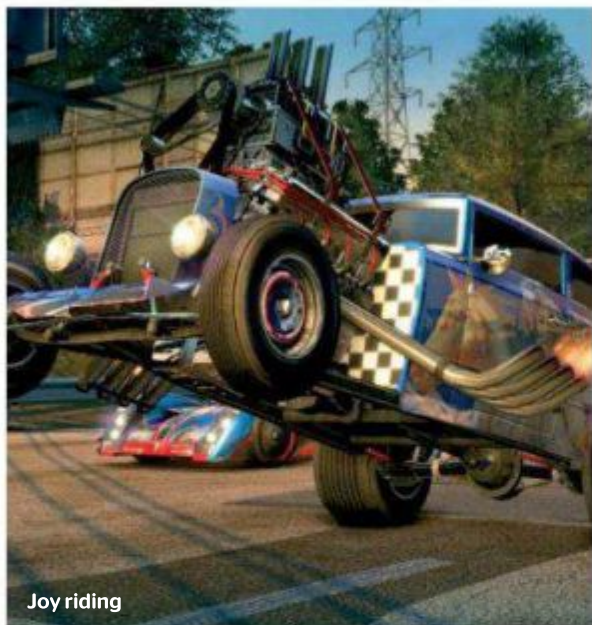


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A PARADISE INDEED

THE NEW RELEASE OF THE CLASSIC RACING TITLE DELIVERS WHAT IT PROMISES.

BURNOUT PARADISE WAS a bit ahead of its time when it hit the market in 2008. We were too busy lamenting the loss of *Burnout 3's* excellent crash mode and the creation of an open world in a game that, well, didn't really need one. It's fair to say that the last 10 years have been very, very kind to the game, and *Burnout Paradise Remastered* is here to remind you that it's still a hell of a ride.

Burnout knows you're only here to go fast, and the upgraded graphics make an already gorgeous game even more eye-popping. The open-world map—races don't take place on tracks, but through set portions of the open city, letting you plan your own route—is huge and a joy to explore. Plus, while we still don't have crash mode, there's a real satisfaction in seeing your car slow-motion

crumble after a misplaced turn. Some of the original problems are there—the “narrator” DJ Atomika is as annoying as his name—but they're very small parts in a fantastic whole and can be easily overlooked.

The game includes all the downloadable content that was originally released, but if you weren't a fan initially, this isn't the game to turn you. Likewise, it's not for people looking for a “new” *Burnout* experience. That's fine, though: *Burnout Paradise* was fantastic, and this is a great chance for new fans to experience a unique concept executed extremely well, which can be rare in racing games (looking at you, every *Need for Speed* since *Underground*). As soon as the game's opening song starts—“Take me down to the Paradise City / Where the grass is green and the girls are pretty”—and your car leaves the garage, you'll be smiling all the way home. *Casey Holiday*



BURNOUT PARADISE REMASTERED
(Electronic Arts)

MUSIC RECOMMENDATIONS



IRON REAGAN/GATECREEPER
Split
(Relapse Records)

Iron Reagan have gone halvesies with ascendant Arizona death-metal commandos Gatecreeper. Well, almost: This time around, the proverbial Reaganites contribute five tracks to Gatecreeper's three, but both bands offer up top-notch material. IR vocalist Tony Foresta (also

of Municipal Waste) and his all-star thrash squad crank out politically charged rippers like “Warning” and whammy-bar workout “Burn for This,” while Gatecreeper saw off a pounding trilogy of Swedish-influenced death dirges including “War Has Begun” and the instrumental intro “Daybreak.” *J. Bennett*



THE SWORD
Used Future
(Caroline Distribution)

The Sword have made a tidy career out of reprising the riff-riding style of their classic-rock forbearers with a proclivity for sci-fi lyrics and a distinctly stoner-friendly aesthetic. On their sixth album, the trippy Texans have expanded their sonic palette with heavy synth use: Wrap your ears

around instrumental interludes “Brown Mountain” and “Nocturne,” which punctuate bong-rattling rockers like “Deadly Nightshade” and “Book of Thoth.” Meanwhile, “Sea of Green” combines pulsing synths with twangy Southern-rock guitars, producing an effect not unlike MTV-era ZZ Top. *JB*



JANE CHURCH
“This Here City”
b/w “Rocket to the Kremlin”
(self-released)

There's a lyric in “This Here City” that goes, “As the sky turned cotton candy / I felt a shiver through my bones,” which encapsulates the music of Jane Church, the solo project of Queens native Jackson Church. Sweet and jangly, yet wistful and yearning, this fuzz-toned lite rock walks the

line between Dylan (as in Bob) and DeMarco (as in Mac). Tinkling piano and a scrap of fairground organ highlight the A-side of this digital single, while a glimmering flange illuminates the slightly more blustery “Rocket to the Kremlin.” Perfect beer-and-sunset tuneage. *Polly Watson*



SPIRIT
It Shall Be: The Ode & Epic Recordings 1968-1972
(Esoteric Recordings)

Like Moby Grape, Spirit was one of those '60s bands whose musical integrity rendered them *too good* for stardom. They had the elements: a psychedelic guitar god who played with Hendrix (Randy California) and killer songs—two of which are classic-rock radio perennials (“I Got a Line on You” and

“Nature's Way”) and one that some claim Zeppelin nicked for “Stairway to Heaven” (“Taurus”). In this five-CD box set, one gets Spirit's first half-dozen albums and an array of strays by one of rock's trippiest shoulda-beens: You're guaranteed to see trails during “Topanga Window.” *Michael Simmons*

BOOK RECOMMENDATIONS



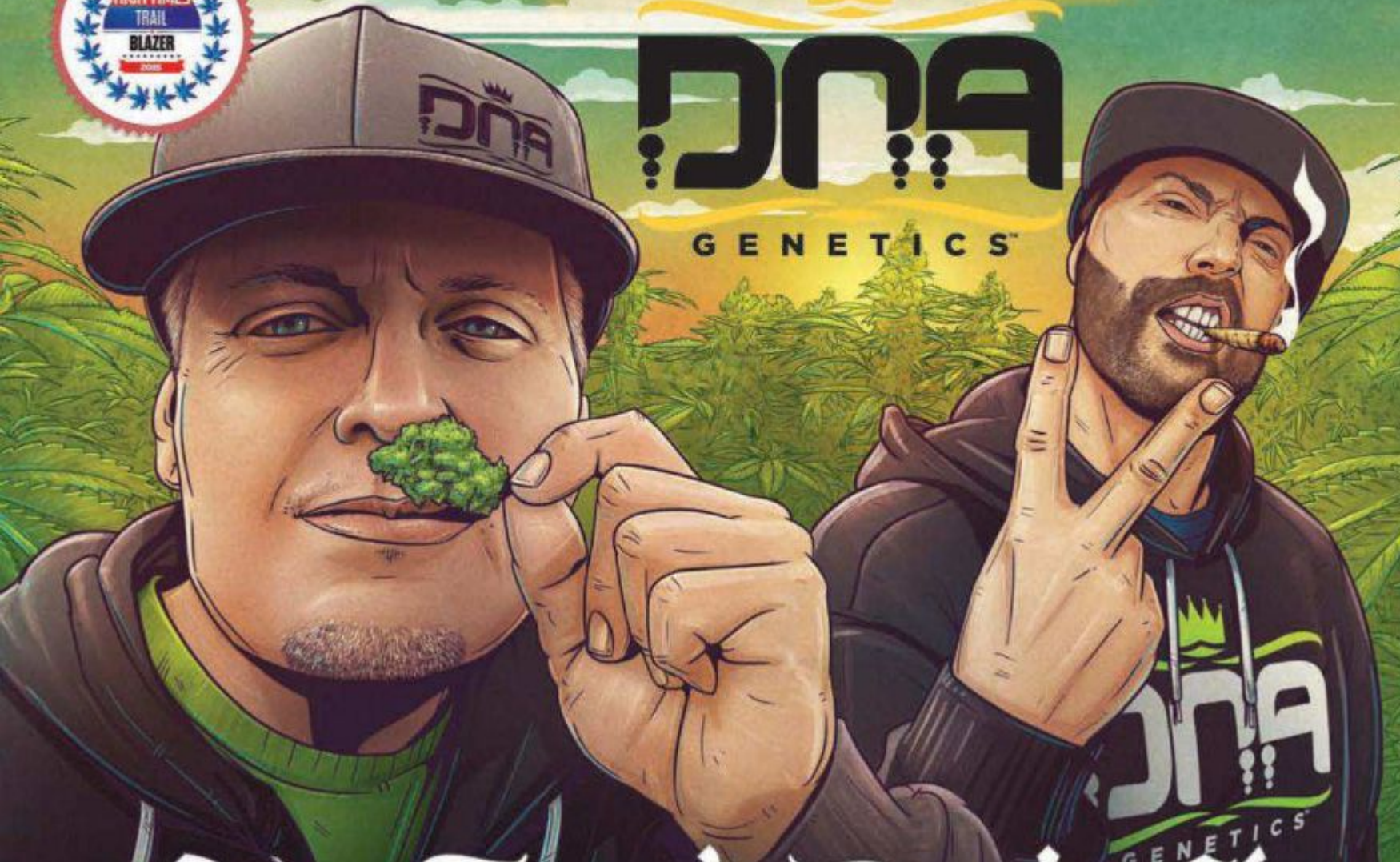
EVERYTHING'S BIGGER IN TEXAS:
The Life & Times of Kinky Friedman
Mary Lou Sullivan
(Backbeat Books)

Polymath American maverick Kinky Friedman has finally been blessed with the biography he's earned. Sullivan captures the singer, songwriter and political candidate at his best (he's one of Bob Dylan's favorite songwriters) and worst (epic addictive appetites). The author notes the Kinkster's

ability to cut across ideology (he's pals with Presidents Clinton and Bush the younger), class and music (he hangs with Willie Nelson and Iggy Pop). His raw talent, politically incorrect wit and respect for truth make him authentically Kinky—and at 73, he continues to make new fans. *MS*



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DRUGS IN THE MAIL

NEITHER SNOW NOR RAIN NOR LEGALIZATION ALLOWS FOR PUTTING POT IN THE MAIL.

J.J. McCoy is Senior Managing Editor for New Frontier Data



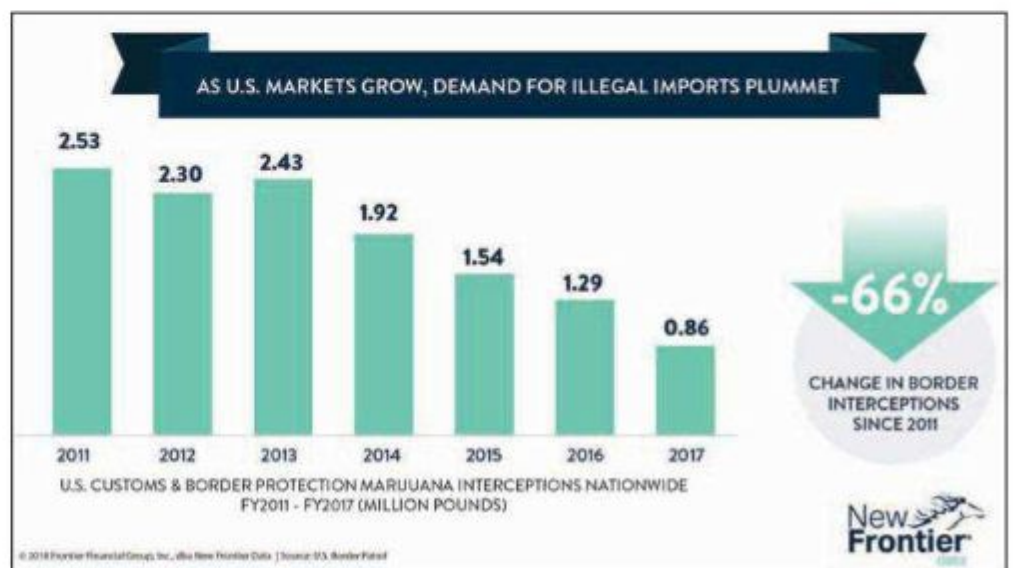
WITH THE INCREASED popularity and public support of legalized cannabis in the United States and Canada, the US Postal Inspection Service (USPIS) reports that pot is likewise increasingly being sent through the US Postal Service, a practice that, due to federal law, remains a crime regardless of the legal status of cannabis in the state where it's mailed to or from.

In January 2018, a congressional report found the Postal Service lax in its vigilance and detection capabilities. A Senate Homeland Security and Governmental Affairs investigations subcommittee found that the Postal Service's advanced electronic-data system used for identifying suspicious packages only captured information from about one-third of international packages in 2017, with some 318 million packages unscreened—leaving Chinese opioid manufacturers largely unchallenged to ship potentially lethal substances like fentanyl (which is up to 50 times more potent than heroin) to customers in the United States.

The 100-page report noted how some Chinese manufacturers contacted online insist that customers pay for international deliveries via Express Mail Service, which uses both the US and the foreign country's government mail systems rather than private shippers such as FedEx or DHL, which are deemed likelier to draw US Customs and Border Protection's attention.

Despite the heightened concern, the Senate report showed no significant improvement in collecting data throughout 2017. The Postal Service reports making the collection of electronic data "a priority," while Chinese authorities say they are "ready to work with the US to enhance our cooperation in this field."

One USPIS inspector (given anonymity for speaking without authorization) concurred that the agency's "primary focus is on fentanyl and synthetic opioids now," but added that "if it was up



THE AGENCY'S "PRIMARY FOCUS IS ON FENTANYL AND SYNTHETIC OPIOIDS NOW," BUT "IF IT WAS UP TO [US ATTORNEY GENERAL JEFF] SESSIONS, ALL AGENCIES WOULD BE WORKING MARIJUANA CASES ONLY.

to [US Attorney General Jeff] Sessions, all agencies would be working marijuana cases only. Kids would be forced to watch *Reefer Madness* every day. The opioid crisis has forced him to refocus there. There's a lot of pressure on us to identify the mailings that are coming out of China."

In fiscal year 2015 (the year with the most recent figures available), the USPIS seized about 34,000 pounds of cannabis. The number of confiscated cannabis packages has reportedly increased by more than 400 percent since 2007, though statistics do not track whether such packages are more likely intended for trafficking or personal use.

Traffickers can get creative and inventive, whether by the use of exotic means or everyday objects to conceal contraband. The USPIS offered recent examples of cannabis seizures, including:

A Black & Decker tool holding four separate bags of pot;

Eight different five-gallon Home Depot buckets, each wrapped in plastic

and packed with 12 pounds of cannabis apiece;

Labeled cans of corn, each matching the weight listed on its label, but containing marijuana packed by traffickers using a can sealer;

What a woman in rural South Dakota thought was a new television, but instead proved to be three large bricks of cannabis weighing about 50 pounds, with an estimated street value of \$100,000—authorities speculated that it came from a Mexican drug cartel having used an incorrect address;

A seemingly authentic jukebox, seized by inspectors in San Diego and containing product worth an estimated street value of \$350,000.

Although federal authorities have started to concentrate on interdicting the shipment of fentanyl, which caused 20,100 US overdose deaths in 2016 alone, they're still wasting valuable resources on stopping the shipment of pot, which has caused zero overdose deaths in the entirety of recorded human history. 🌿

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TOP 5 STRAINS



(OG Kush)
 "Good deal for Kush in a medical-only city. The county banned all rec sales!"
 -Klamath Falls, OR

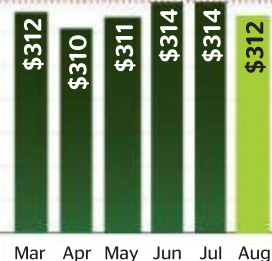
(Wookies)
 "Indica-dominant, intricate mix of The White, Chem 91 and Girl Scout Cookies"
 -Yuma, AZ

MARKET ANALYSIS

Prices by the ounce

All indices, with the exception of the Southern Index, finished August below their previous month's average. However, the US Price Index continues to hold steady at \$312. The US Price has finished between \$310 and \$314 per ounce for the last six months. August highlighted the massive discrepancy between prices in legal and prohibition states as the Southern Index closed the month \$97 above the Western Index.

US Price Index
 YTD Average: \$314



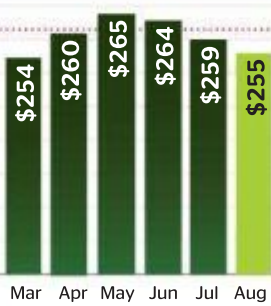
Eastern Index
 YTD Average: \$337



Southern Index
 YTD Average: \$345



Western Index
 YTD Average: \$261



(Platinum OG)
 "Excellent weed. It costs enough!"
 -Nashville, TN

TRANS HIGH MARKET QUOTATIONS

STATE	CITY	STRAIN	PRICE
ALABAMA	Huntsville	Cali Kush	400
ALASKA	Anchorage	Kush	360
ARIZONA	Glendale Yuma	Blue Dream Wookies	200 280
ARKANSAS	Little Rock	Gorilla Glue	420
CALIFORNIA	Los Angeles San Diego	Wookies Superman OG	150 260
COLORADO	Denver	Blue Dream	180
CONNECTICUT	New Britain	Platinum OG	320
FLORIDA	Miami	Sensi Star	380
GEORGIA	Newnan	Gas	320
HAWAII	Kahului	Jager	280
ILLINOIS	Sterling	Super Silver Haze	320
KANSAS	Wichita	Trainwreck	400
LOUISIANA	Bogalusa	Loud	280
MAINE	Biddeford	OG Kush	325
MARYLAND	Baltimore	Bruce Banner	300
MASSACHUSETTS	Boston Salem	Green Crack Granddaddy Purple	280 345
MICHIGAN	Ann Arbor Detroit	Cookies & Cream Blue Dream	405 250
MINNESOTA	Minneapolis	OG Kush	250
MISSISSIPPI	McComb Meridian	Gelato Blue Dream	450 400
MONTANA	Kalispell	Animal Cookies	280
NEVADA	Henderson Las Vegas	Lemon Haze Deadhead OG	330 350
NEW MEXICO	Albuquerque	Harle-Tsu	335
NEW JERSEY	Hackensack Seaside Heights	Sour Diesel Animal Cookies	350 400
NEW YORK	Newburgh New York	Birthday Cake Strawberry Cough	320 400
NORTH CAROLINA	Burlington Greenville	OG Kush Sour Diesel	250 450
OHIO	Cleveland Defiance	Gorilla Glue AK-47	280 300
OKLAHOMA	Tulsa	Animal Cookies	280
OREGON	Bend Klamath Falls	Tangie OG Kush	250 225
PENNSYLVANIA	Chambersburg Lebanon	Loud Gorilla Glue #4	450 420
TENNESSEE	Knoxville Nashville	Sour Kush Platinum OG	280 375
TEXAS	San Antonio	Girl Scout Cookies	500
WASHINGTON	Tacoma	Animal Cookies	250
VIRGINIA	Richmond	Blackberry Kush	300
WEST VIRGINIA	Parkersburg	Gorilla Glue	280
WISCONSIN	Franklin	Gorilla Glue #4	300
INTERNATIONAL			
AUSTRALIA	Ballarat	Blue Cheese	A\$300
CANADA	Hamilton	MK Ultra	C\$260
UNITED KINGDOM	South London	Skunk	£130

High Times wants to know what you're smoking. Submit your strain information including location and price by the ounce to thmq@hightimes.com, or tweet us (#THMQ).

(Animal Cookies)
 "This is the dank!
 Great strain."
 -Seaside Heights, NJ

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Mac Lucci featuring Snoop Dogg

Big Gigantic featuring Waka Flocka Flame

Belly

Ziggy Marley

Action Bronson

Stick Figure featuring Collie Buddz, Dizzy Wright, Iration & J Boog

Balt Getty featuring Method Man & KO

Caligula featuring Wiz Khalifa

Pell

Tosh 1

Zoey Dollaz featuring Junior Reid



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FRIENDLY FARMS

The folks at Friendly Farms began their careers in the cannabis industry exactly where the name implies, the farm.

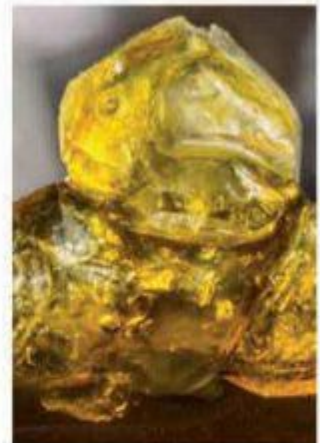
For several years Friendly Farms built relationships with the 420-friendly people of Northern California, and forged bonds with cultivators, processors, and those who simply enjoy cannabis.

As time passed the team saw an opportunity to move into cannabis extractions and selected live resin as its product of choice. In May of 2017, Friendly Farms launched its brand in a new direction and presented to the world its high-quality concentrates.

Every flavor is a hit for Friendly Farms, and its menu of extractions offers a variety of strains with something for everyone to enjoy. Friendly Farms' house strains include potent and flavorful contenders that delivers clean, tested, and effective dabs with every concentrate.

For more info contact us:

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IG: @FRIENDLYFARMS420



THE HIGH GROUND

DESPITE OBSTACLES, THE 2018 SOCAL CANNABIS CUP DEMONSTRATED POT'S POWER TO UNITE.

BY MIKE HUGHES

ANYONE WITH EVEN A CURSORY KNOWLEDGE of the cannabis industry over the last decade understands the potential pitfalls awaiting companies that promote pot. Despite the incredible gains of the marijuana-law-reform movement, weed is still a Schedule I narcotic encumbered by 80 years of government-issued propaganda.

Regardless of the will of the voters, local governments and city councils sometimes go their own way. *High Times* is familiar with this dynamic. In our 30-plus years of hosting cannabis events, we've faced scrutiny in weed-friendly locales like Seattle, Denver, Los Angeles and even Amsterdam (where the Cannabis Cup was inaugurated in 1987).





Powerhouses Nas, Lii Wayne and 2 Chainz headlined the three-day Cannabis Cup.



Friendly Farms, winners of Best Hybrid Concentrate, represent.



Apt ink

In fact, we ultimately found a home for our SoCal Cup at the National Orange Show Events Center in San Bernardino when local authorities forced us from a venue in downtown Los Angeles in 2013. Since then, we've returned to the NOS each year, hosting epic events celebrating cannabis culture and bringing thousands of attendees to the Inland Empire. So when Proposition 64 took effect this year, legalizing cannabis in the Golden State, we planned a historic legal weed Cup in San Bernardino over the 4/20 weekend.

Sadly, the San Bernardino City Council made a last-minute decision to block the lawful sale of cannabis-based products during the Cup. This decision was made in part due to an ordinance adopted by the city just eight days before the Cup requiring a 60-day lead time for approval of marijuana events. Given the legalization mandate handed down by the voters of California in 2016, as well as our productive history with the city of San Bernardino and our track record of hosting safe, responsible and law-abiding events, the decision was a major disappointment.

But as *High Times* has proven time and again, you cannot stop the marijuana movement. The show must go on—and indeed it did. The Cup is a celebration of all things cannabis, and those who joined us over 4/20 weekend were not disappointed.



A jar of gorgeous ganja on display



San Bernardino provided ideal outdoor puffing weather.



SoCal tattoo artists provide onsite ink.

JESSE PAATZ, KRISA SCHLUETER (4)

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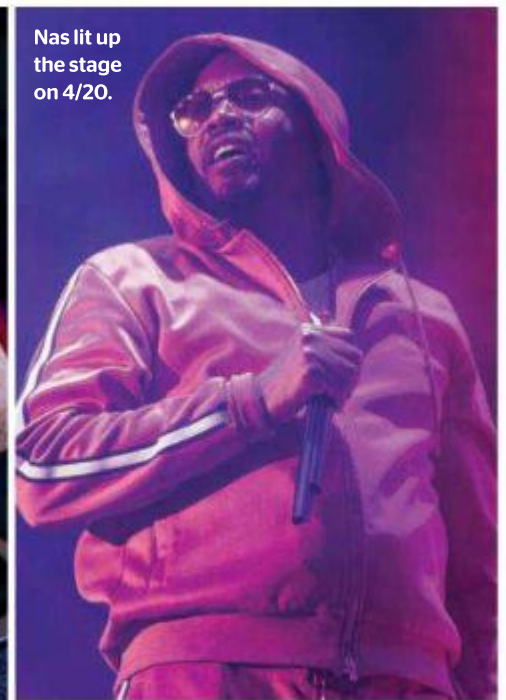
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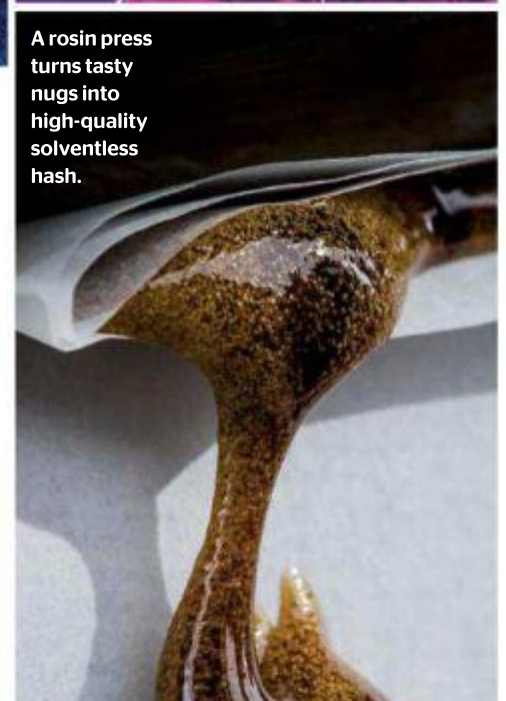
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Rolling experts Futurola were on hand crafting joints.



Nas lit up the stage on 4/20.



A rosin press turns tasty nugs into high-quality solventless hash.

With the high holiday falling on a Friday, the 2018 SoCal Cup was a rare three-day event. When the doors opened, scores of enthusiastic stoners explored the massive scope of the fairgrounds, complete with Ferris wheel, super slide and even a petting zoo. Throughout the event, vendors showed off innovative pot products, and there was plenty of puffing for Cali's medical-pot patients in the Prop 215 area.

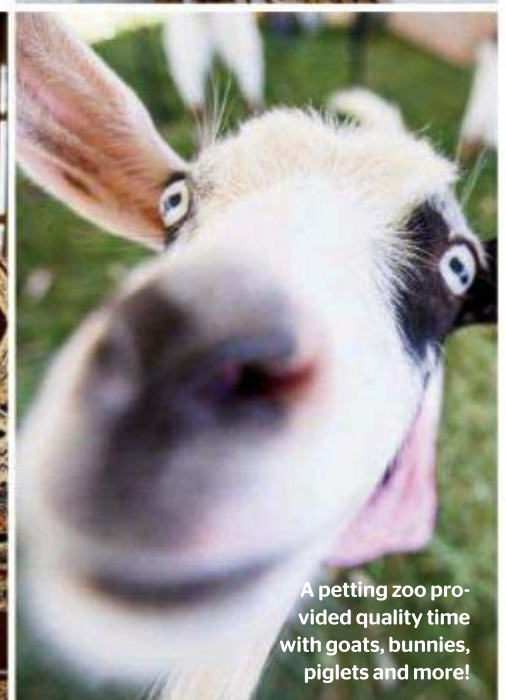
Epic booths from Exotic Genetix, Family Farms and Ganja Gold, along with sponsors Select, 710 Kingpen and Kush Bottles, made certain that attendees had the desired experience, and Friday's musical lineup sealed the deal. Lupe Fiasco and Rick Ross got the 4/20 crowd hyped for opening-night headliner Nas, whose electric performance sent everyone home high and happy.

While seminars had been a staple of *HT* events past, we changed things up for the 4/20 Cup, opting instead for live podcasts, providing attendees a behind-the-scenes look at the making of these shows. Over the weekend, *High Times Green Room* hosted conversations with Raza Lawrence, Mike Glazer, Jason Pinsky, Jinxproof Genetics, Raw Papers and Freeway Ricky Ross.

This podcasting format also saw the long-awaited return of *Free Weed from Danny Danko*, which featured cultivation-centric talks with Kyle Kushman, Harry Resin, Nicole West and Colin Gordon. The live performance allowed for audience members to ask their grow questions and get advice from these cultivation luminaries.



Free Weed from Danny Danko returned with guests Nicole West and Colin Goron.



A petting zoo provided quality time with goats, bunnies, piglets and more!

JESSE FAATZ (5)

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An indoor vending area gave attendees a break from the sun.



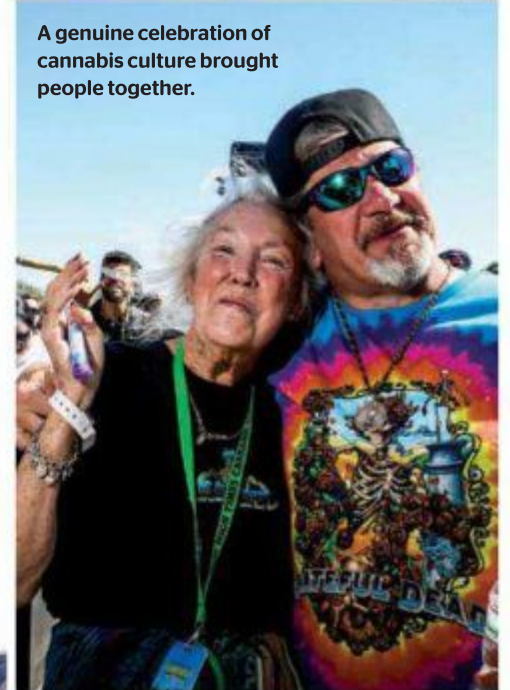
Puffy offers an app to connect cannabis enthusiasts.

Outside on the fairgrounds, 710 Life and Hyer showed off their concentrate-consumption wares. Hyer's Dab Rig ultimately took first place in the Best Product category, while 710 Life's eNail nabbed third-place honors (Hyer also took the Best Vape Pen award).

Non-solvent hash fans were treated to a squash-off competition in the Rosin Tech Products booth. Presented by Bobby West, the squash-off pitted attendees against each other to see who could press the best rosin hash. Truly, there were no losers in this contest. And, speaking of presses, for the award show Sunday, Trinator generously donated a TRP Stack press to be gifted to the first-place Non-Solvent Hash winner.

Former heavyweight champ Mike Tyson, who made waves earlier this year with the announcement of his 40-acre cannabis ranch, made his presence felt at the SoCal Cup, reeling in our first-ever award for Best Brand (Tyson Holistic). Iron Mike also took third place in the Topical category for CopperGel Ice by Tyson Ranch.

Saturday daytime acts Ever, Triple XL and Fabolous kept the music flowing throughout the afternoon and, as the sun set, Raekwon took the stage to a wild reception. The Wu-Tang Clan alum, performing solo at the Cup, had the crowd rapping along before giving way to Saturday headliner Lil Wayne. Wheezy did not disappoint in his second go-around performing at this venue, and he closed out day two on a decidedly high note.



A genuine celebration of cannabis culture brought people together.



Big rig dabs



Lil Wayne did not disappoint.



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The mainstage was lit throughout the long weekend.



2 Chainz closed out the Cup.



AS HIGH TIMES HAS PROVEN TIME AND AGAIN, YOU CANNOT STOP THE MARIJUANA MOVEMENT.

Sunday at the Cup was all about the awards show, when *HT* honors the very best pot, hash, edibles, topicals and CBD products in SoCal. The “Highest Host” Adam III emceed the show and deftly kept the proceedings entertaining at a rapid pace. Team Elite Genetics and Papa & Barkley were big winners, placing in mul-

iple categories. (For a complete list of winners from the 2018 SoCal Cup, see page 54.)

Following the awards show, the main stage stayed lit as Rich the Kid, Yo Gotti and TI performed for the stony crowd. Finally, Sunday-night headliner 2 Chainz closed out the Cup in style with an energetic show that

even included some new material.

As the curtain came down on the final day of the 2018 SoCal Cannabis Cup, it was clear that nothing can stop the momentum of marijuana. No obstacle is too great to overcome, and *High Times* will continue to fight for the right to host the world’s greatest pot parties. ✨

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THE BLOOMBOX™

FLOWERS 9 PLANTS

YIELD: 1/2 to 1 lbs.



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FLOWERS 4 PLANTS

YIELD: 1/4 to 3/4 lbs.



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BEST SATIVA FLOWER

1st Place: Dosi-Orange #9 by Greenline Organics
2nd Place: Peach Ringz by Atrium
3rd Place: J1 by Team Elite Genetics

BEST INDICA FLOWER

1st Place: XXX OG by Life Is Good Healing
2nd Place: 92 OG by Atrium
3rd Place: Billy Kimber OG by Garrison Lane

BEST HYBRID FLOWER

1st Place: Wedding Cake by New Amsterdam Naturals with Cannastar
2nd Place: Sugar Biscuits #8 by Kanna King Farms in collaboration with Point Loma Patient Consumer Co-op
3rd Place: Tangimal Cookies by Bosky Genetics powered by Bio Bizz

BEST PREROLL

1st Place: Kimber Cannon by Garrison Lane
2nd Place: Lemon Tree by Ganja Gold
3rd Place: Skywalker OG Kief Infused Preroll by Mary Jane Univ in collaboration with A to B Official

BEST BRAND

Tyson Holistic

BEST EDIBLE

1st Place: Cookies and Cream Cheesecake by The Huney
2nd Place: Sugar Free Dark Chocolate Cherry 90mg by Punch Edibles
3rd Place: Strawberry Fruit Taffy by Cheeba Chews

BEST TOPICAL

1st Place: Releaf Balm 3:1 by Papa & Barkley
2nd Place: Lip It CBD by Gemstonz
3rd Place: CopperGel Ice by Tyson Ranch

BEST CBD FLOWER

1st Place: ACDC Cookies by Brown Dog Cannabis in Collab w/ Med Tree Seeds

BEST CBD CONCENTRATE

1st Place: Remedy Full Plant Live Resin by Nug
2nd Place: Full Spectrum CBD Purple Cookies Sauce by Humboldt Solutions / Pure Terps
3rd Place: Orange Drop CBD Sauce by Gold Drop

BEST MEDICALLY INFUSED PRODUCT

1st Place: Wax Cigar by Barewoods
2nd Place: Moonrock Ice by Dr. Zodiaks Moonrock
3rd Place: Pomegranate Preroll by Next Level Prerolls

BEST VAPE PEN CARTRIDGES

1st Place: Blueberry Haze by Cobra Extracts

2nd Place: OG Kush Vape Pod by Stiilzy

3rd Place: Tahoe OG by Stick.e.vape Powered by Tradecraft

BEST NON-SOLVENT HASH

1st Place: Clementine by Greenwolf in collaboration with Rosin Brothers
2nd Place: Rainbow Flame 6 Star Live Rosin by Papa Select
3rd Place: Rainbow Flame 6 Star Ice Wax by Papa Select

BEST INDICA CONCENTRATE

1st Place: Lemon Fuel by Critical Concentrates with Alien Labs
2nd Place: Crème de la Crème Sauce by Team Elite Genetics, processed by Kind Bill/Ry Prichard
3rd Place: Mega Wellness OG LR Terp Sauce by Nameless Genetics

BEST HYBRID CONCENTRATE

1st Place: Doug's Diesel by Friendly Farms
2nd Place: Peach Ozz Sauce by Team Elite Genetics, processed by Kind Bill/Ry Prichard
3rd Place: Orange Strawberry Phanta by Critical Concentrates with Ohmega Farms

BEST SATIVA CONCENTRATE

1st Place: Biscotti Live Resin Diamond Sauce by Team Elite Genetics, processed by Kind Bill/Ry Prichard
2nd Place: Forbidden Fruit by Atrium in collaboration with Beezle

3rd Place: Queso Fuego Live Resin Sauce by Nameless Genetics

BEST CBD EDIBLES

1st Place: Balance Therapy Drops 1:1 by the Pharmaceuticals Co.
2nd Place: Cannabis CBD Tincture 18:1 by Val's Organics w/ The Weed Studio City and Pop Naturals
3rd Place: Releaf Tincture 1:1 THCa CBD by Papa & Barkley

BEST CBD CARTRIDGES

1st Place: 10:1 CBD Cali-O by Loudpack Farms with Loudpack Extracts
2nd Place: Mango CBD Vape Pod by Stiilzy
3rd Place: CBD Boost by Pure Vape

BEST BOOTH

1st Place: Exotic Genetix
2nd Place: Friendly Farms
3rd Place: Ganja Gold

BEST PRODUCT

1st Place: Hyer Dab Rig
2nd Place: Exotic Genetix Mint Chocolate Chip Seeds
3rd Place: 710 Life eNail

BEST GLASS

1st Place: Dab Nation with IDab - Rosen Tech Product Glass Beaker

BEST VAPE PEN

1st Place: Hyer - Vape Pen

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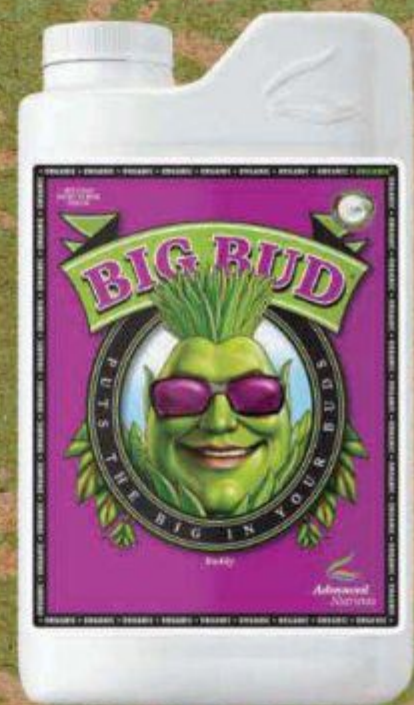
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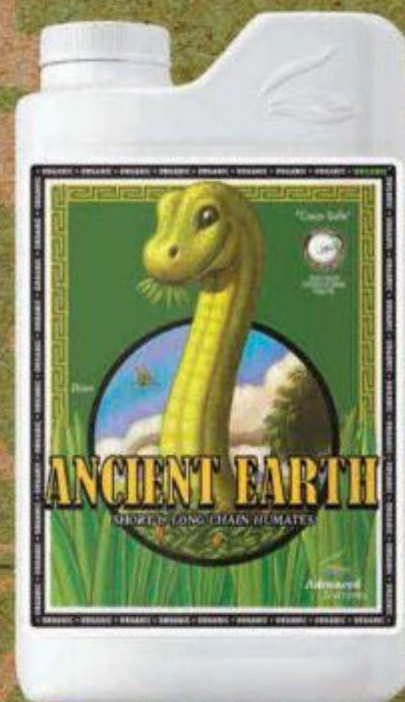


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TESTING THC

THE SUCCESS OR FAILURE OF POT PRODUCERS IS OFTEN DETERMINED BY CANNABIS LAB TESTS. BUT WHAT IF THESE TESTS AREN'T ACCURATE? WE INVESTIGATE THC TESTING IN OREGON.

BY STINKBUD

IN OREGON, CANNABIS test scores are a big part of every recreational purchase, and both wholesale and retail prices are affected by the results. The higher the percentage of THC, the higher the price and, hopefully, the higher the consumer. But what if I told you that the THC-content analysis results of the flower you're currently smoking could vary over 10 percent from lab to lab? This would mean that all those test scores are virtually meaningless. You may be paying twice as much as you should, or you might just be getting the deal of a lifetime. So just how reliable are lab results for cannabis products? That's what we wanted to find out.

For Oregon farms, cannabis testing is part of everyday life. Each batch must be tested by an accredited lab before it can be sold. Many people have suspected that there might be differences between labs, but there's no way to know for sure without running a comparison. We decided the only way to know which labs are the most accurate would be to send the same sample to a number of different labs and compare the results. What came back was truly shocking.

To ensure we were providing standardized samples for the comparison, we approached testing a bit differently than normal. We ground up a small amount of Bruce Banner buds



Bruce Banner showing its classic “foxtail” formation.



Dividing up the test samples

and placed them on a black foam-core board. We then separated the cannabis shake into multiple piles, making sure they were all consistent. We received a few puzzled looks from employees as it appeared that we were preparing to snort a huge line of shake!

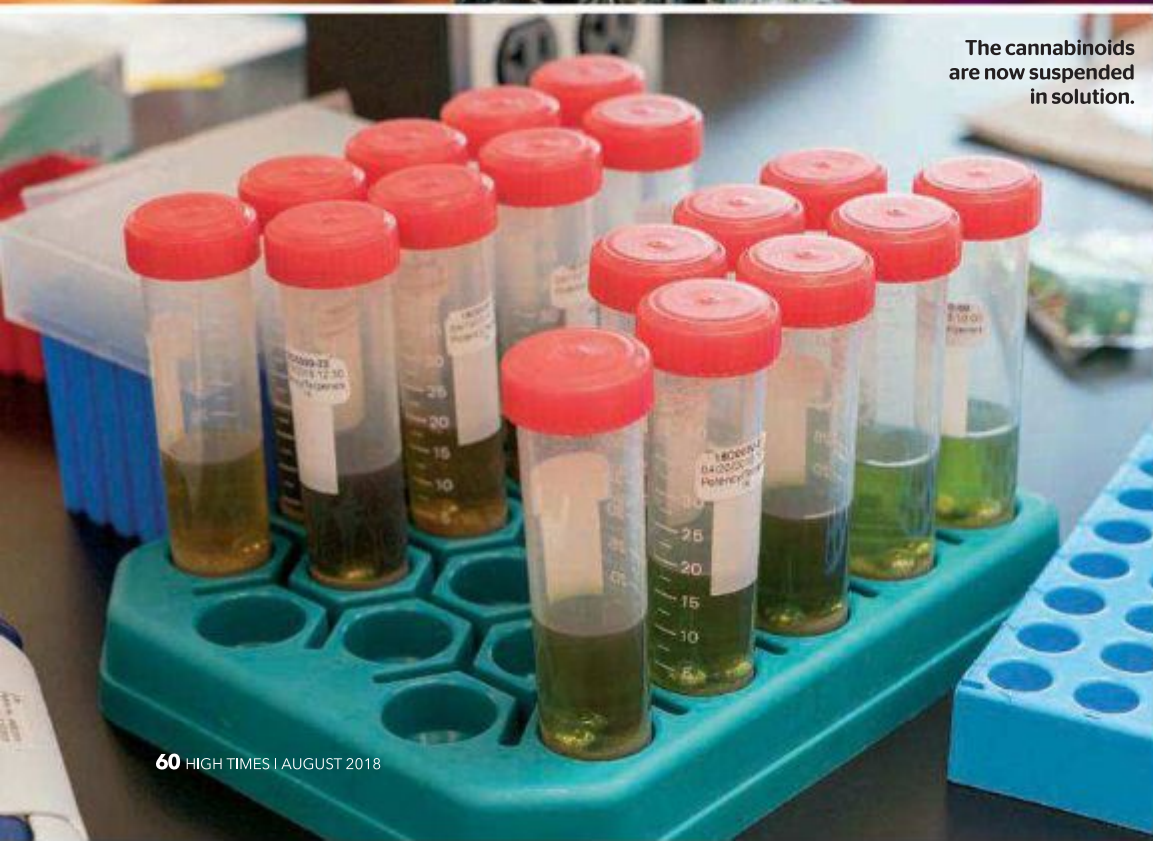
A total of six samples were given to the labs for testing. Since the samples weren't for resale, we didn't bother with the pesticide, mold or terpene tests normally required by law.

Before getting to the results, let's talk a little about the testing process. How are samples taken? What is the process and what type of equipment is used? How can we be sure the testing is accurate? There were a lot of questions looming before we even got started.

The first step in the testing process is picking up the product. Each lab sends out a representative to obtain the samples. The lab rep examines the flowers and picks the ones that are best representative of the harvest. They're looking for what they consider an average sample for each batch. In Oregon, batch size is limited to 15 pounds. So this means that a harvest of 25 pounds of a single strain must be broken into two different test batches and the testing process must be done twice. Some variation can be expected but, in theory, the same harvest should have very similar results from batch to batch, regardless of the lab used.

Every lab is careful in its labeling procedures. Oregon law requires tag numbers for every stage of the process, which must be logged into the Oregon Liquor Control Commission (OLCC) database. The OLCC requires that cannabis be tracked at all times—including when drivers are transporting product.

When a batch of flower is sent for testing, the results are final and cannot be resubmitted. Growers are not allowed to send out multiple batches to different labs and then pick the highest number. In order for our little experiment to comply with the law, we had to label the test samples “not for use.”



The cannabinoids are now suspended in solution.

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Clockwise from left: Diluted samples are prepared for the HPLC. All samples are weighed to ensure accuracy. The HPLC separates the different cannabinoids. Proper labeling procedures reduce mix-ups.

Once the samples arrive at the lab, the first thing done is proper logging and labeling. This isn't just for legal reasons; it's also crucial in making sure none of the strains get mixed up. It's easy to imagine how many samples arrive at the lab every day and how quickly things could go wrong without strict logging and labeling procedures. What may sound like a dream job is actually a stoner's nightmare! If you're used to hanging out with a bunch of dirty farmers, you'll immediately feel uncomfortable in the sterile lab environment. All this cleanliness serves the purpose of making sure the samples don't become contaminated.

Once everything is logged in, the samples are put into a temperature- and humidity-controlled environment until ready for testing. The first step of the testing process is to grind the flower into a fine dust. Some labs freeze the product in dry ice before grinding as this helps reduce damage to the fragile trichomes, making the results more accurate. The fine cannabis dust is then added to a measured solution and shaken until all



the cannabinoids are evenly mixed. What you end up with looks a lot like a marijuana milkshake.

When the milkshake is finished, the material is placed into a sonic bath to further separate the cannabinoids from the plant material. The sonic bath is like a little Jacuzzi for test tubes but instead of bubbles it uses ultrasonic sound waves. The final step in the separation process involves placing the samples into a centrifuge, which spins the materials at a high speed. The heavier plant material collects at the bottom of the test tube and the clean cannabinoid solution is left at the top.

A small sample is removed, filtered and diluted once again. The material is loaded into a high-performance liquid chromatograph, often referred to as an HPLC. This testing procedure is more accurate than gas chromatography as no heat is used during the process. Heat applied to THC changes its properties, making gas chromatography results less precise. The HPLC separates each compound by using its unique electrical charge and measuring the quantity with a UV sensor. If this all sounds like hard-core science, that's because it is!

The results of the HPLC are fed into the inventory tracking system. The amounts of THC, THCA, CBD, CBN and many other compounds are logged into the database, and the results are sent to the grower or company whose product was tested. These results are used to create packaging and come up with the final pricing structure.

How important are THC percentages? It's not an exaggeration to say they can be the difference between whether a pot-production company survives or goes under. If you show up with a Bruce

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Lab techs work to prepare results that will set pricing for pot products.

Banner strain testing out at 20 percent THC, no one will give you the time of day. But if you show up with a Bruce Banner strain at 30 percent, all the shops start salivating. You've got product that everybody wants. Not only can you sell your product for \$1,000-\$1,500 more per pound, you can actually sell it! In Oregon, many growers have a hard time unloading anything with under 20 percent THC and usually turn low-testing product into oil for cartridges or edibles. So THC percentage is a big deal to every cannabis farmer. Everyone wants the highest results possible, because final pricing is very much influenced by THC percentage as determined by lab testing. When it comes to THC, bigger is better.

How does THC percentage affect the retail cannabis industry? Well, of course, the obvious effect would be that higher THC strains command a higher market price. This isn't necessarily a bad thing if the tests are accurate. No one has a problem with paying a premium price for a 30 percent THC Bruce Banner strain, assuming that's what it really is. It's only a problem when someone is paying

top-shelf prices for mid-quality flower. Of course, in some cases, it actually works in the buyer's favor. For example, you may think you're purchasing some inexpensive mids and end up with a bag of fire!

So on to the test results from our comparison experiment. We've decided to keep the labs used in this experiment anonymous. The primary reason for this comparison test is to find out if Oregon cannabis-testing labs are consistent, not to put anyone out of business. Here are the results, listing THC percentage from low to high:

Lab 1: 20.40% THC,
24.59% total cannabinoids

Lab 2: 22.90% THC,
25.70% total cannabinoids

Lab 3: 24.84% THC,
28.26% total cannabinoids

Lab 4: 26.18% THC,
30.73% total cannabinoids

Lab 5: 26.20% THC,
29.30% total cannabinoids

Lab 6: 30.50% THC,
35.00% total cannabinoids

The test scores for all six labs average out to 25.17 percent THC. You can see some of the lab results are similar, but which test score is correct? The truth is that any one of them could be the correct one. From a farmer's perspective, if you were to use the scores from Lab 1, you would have a hard time selling your strain. None of the shops would be interested because it would be overshadowed by all the higher-testing strains. At the same time, if you used the scores from Lab 6, everyone would be breaking down your door for as much product as they could get. Of course, as mentioned previously, growers are not allowed to shop around for the highest score.

So how can this be? Isn't it the whole point of scientific testing that every result be duplicable? Clearly, we're not seeing a lot of duplication here. In fact, the variation in results here is incredible. How can we be sure what the correct THC percentage is when every lab comes up with a different result?

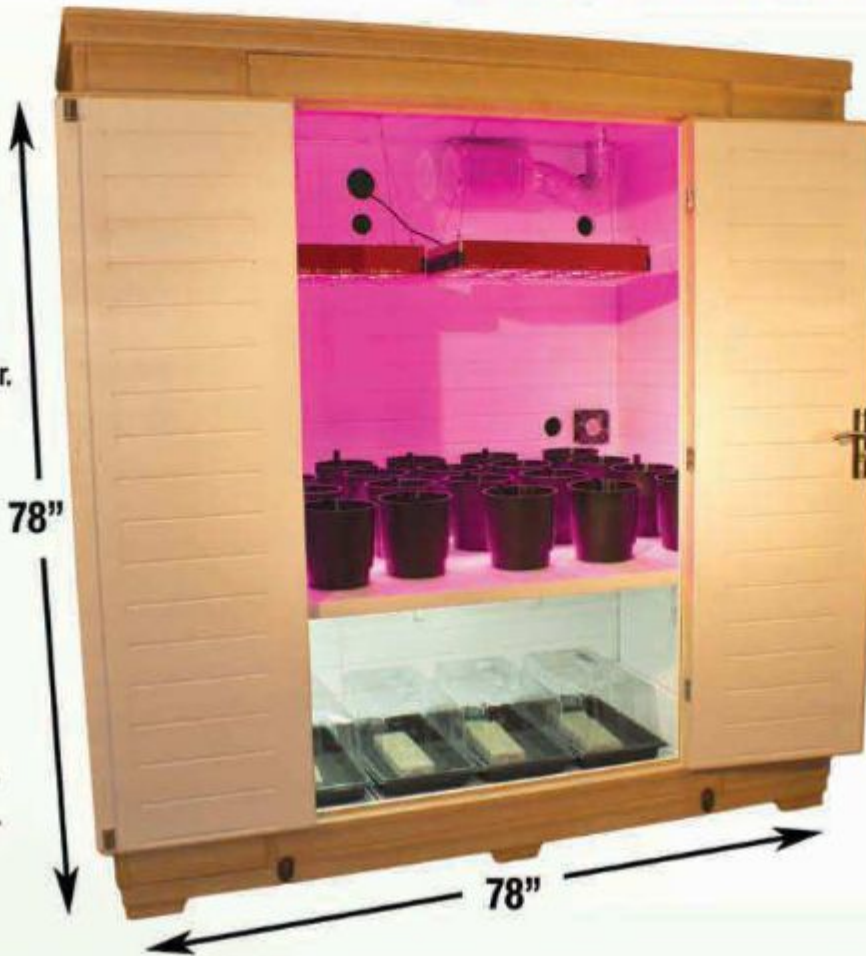
By law, every jar of cannabis must have the THC percentage listed on the side. When someone walks into a rec store to purchase cannabis, they assume what they see on the jars is accurate. What happens when medical patients determine their dosage based on the THC content only to find out that they must now consider which lab did the testing? It's incredibly difficult to explain away the variance in these testing results. You would expect small discrepancies, but this is rather extreme as different labs tested the same cannabis at 20.4 percent and 30.5 percent THC!

Many in the cannabis industry are dependent on these test scores. If they can't hit the high-test mark, they can't make a profit. Growers can't afford to have their products shortchanged by a low-testing lab. If a lab is found to swing to the low side, they won't stay in business for long. At the same time, a lab producing high test scores will draw a huge following almost immediately. None of this is fair. The only real solution is to have some sort of standardized testing system that eliminates the extreme variance we see here. I imagine the OLCC, which likely is unaware of this issue and views its testing rules and regs as a clear-cut scientific solution, will need to step in with a fix. Of course, if this is an issue in Oregon, one can assume it is an issue in other legal states as well. ✨

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An aerial photograph of a vast, dense field of cannabis plants. The plants are in various stages of growth, with some showing bright green leaves and others appearing darker. The field is organized into neat rows. In the upper right corner, a small portion of a person wearing a light-colored shirt is visible, suggesting they are working in the field. The overall scene is a lush, green agricultural landscape.

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TOUR A FAMILY-OWNED AND -OPERATED OUTDOOR CULTIVATION FACILITY WHERE LIVING SOIL AND A NATURAL ENVIRONMENT PRODUCE PRISTINE AND CLEAN POT. *STORY & PHOTOS BY DAVID GOODMAN*



Master grower Ben Short harvests massive outdoor trees at Puffin Farm.



Afghani Kush 47 is ready to harvest. Inset: Jade Stefano holds a package of Remedy, one of Puffin Farm's most popular medical CBD strains.



MOM-AND-POP GROW OP

My niece, Jade Stefano invited me to stay with her and her husband, Ben Short, at their farm in Ellensburg to photograph the annual harvest, something I had wanted to do ever since they started the farm in 2014. On this trip, the plan was for me to be completely entrenched at the estate for the duration of the harvest. Additionally, I would make several field trips to Puffin's processing facilities in Seattle.

As we drove farther from the city, we passed through some of the most beautiful countryside I have ever seen, with gorgeous rolling hills, streams and lush foliage. We arrived in the early afternoon at the farm, which is situated right alongside the Yakima River. As we approached, I couldn't actually see any cannabis; the only thing visible was an eight-foot fence surrounding the entire grow area,

which is mandated by state law to block the view of the plants from outside. We parked and I grabbed my camera bag and went right into the growing field, as the harvest was already in progress.

I arrived just a day after the harvest began, and the Puffin staff was fully into the swing of it. The farmworkers were set up in pairs, one person holding a plant and the other cutting it at the base with a lopper.

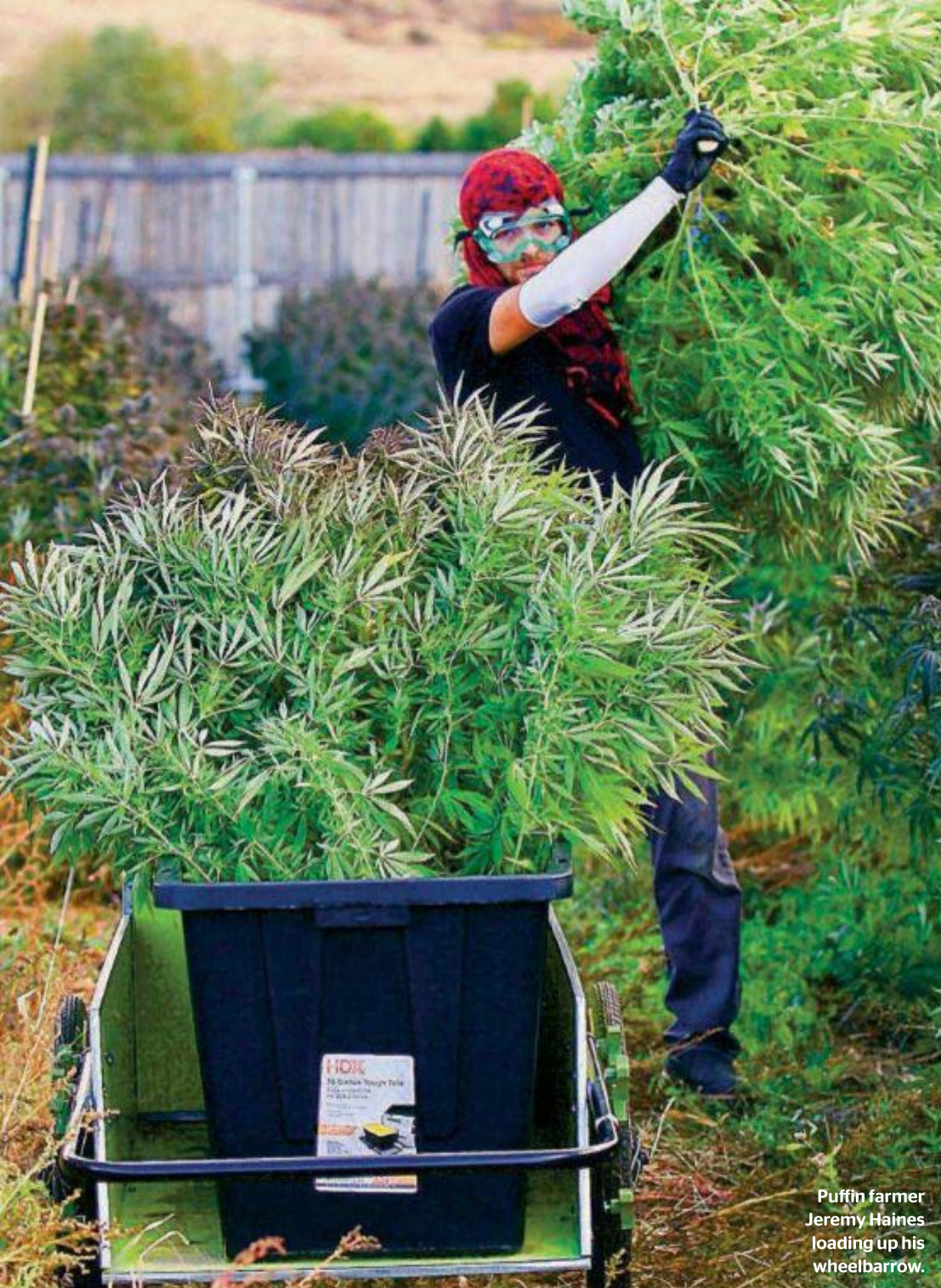
Several other workers lined up to fill their wheelbarrows with the freshly cut plants, then wheeled their loads directly to the drying rooms to be weighed, catalogued, and hung upside down; they'd then head right back out to the field for more.

Over these past few years, Stefano and Short have emerged as two of the most sought-after experts in sustainable

cannabis farming. They claim it was their destiny.

If Puffin Farm looks like a classic mom-and-pop enterprise, you couldn't find a couple more perfectly suited to this situation than Stefano and Short. Short's organic-farming expertise started with his studying sustainable agriculture at Evergreen College, while Stefano's a naturopathic physician with a doctorate from Bastyr University. Together, they practiced their organic-farming techniques growing gourmet mushrooms in California in the early 2000s.

I asked Stefano how she got into pot farming. "We've always loved cannabis and started growing it as soon as we were able," she said. "When cannabis was legalized in Washington State, we were already growing it medically. We realized we couldn't live in Washington and



Puffin farmer Jeremy Haines loading up his wheelbarrow.

have this historic thing happen and just watch it go by and not be a part of it, so it was either move forward with the new system or just stop doing it and be left behind. So we just decided to go for it.”

And since launching in 2014, Puffin Farm has developed a reputation for producing the finest organically grown cannabis utilizing very strict standards of sustainable farming. Short runs the farm and is the head grower, while Stefano is the CEO and heads up operations management and product development. Their simple philosophy is to produce the most organically pure flower possible.

Stefano explained: “We want to grow cannabis that we actually want to smoke! We’re super-picky and we want everything to be organic and natural with no chemicals.” “And not just organic,” Short added, “but we grow *vegetarian* organic,

meaning we avoid products derived from factory-farmed animals such as bone-meal, blood meal or fish meal. All these things are commonly used organic fertilizers, but we don’t use them.”

Instead, Stefano and Short chose to use organic inputs like biochar, rock dust, bat guano and worm castings. The duo has found that over time this has created what they call a “living soil.” Stefano elaborated: “Our soil is a sandy loam river-bottom soil, so we’re starting out with the best type of soil you can get. And we have supplemented it over the last four years with bio char, truckloads of worm castings, alfalfa and guanos. We make aerated compost tea to increase the biodiversity in the soil and help make nutrients available, so less fertilizer is needed. All these things help create and maintain a healthy microbiome, and a

living, biologically active soil is what makes for healthy and happy plants.”

Stefano and Short said they started out with 1 percent organic matter three years ago, and now they’re up to almost 5 percent organic matter—and it’s just going to keep growing from there. “We’re building the soil,” Stefano said. “We’re not eroding it the way most conventional farms do. This is important not only for the long-term productivity of the farm, but also to help in the battle against climate change.”

Stefano explained: “Increased organic matter in soil serves as a carbon sink, which keeps carbon stable and sequestered in the soil instead of releasing it into the atmosphere as CO₂. Organic farms that increase carbon in their soil can get closer to a carbon-negative status and actually offset a good deal of their carbon emissions generated by electricity and fuel use. That’s a really important principle in our farming technique: building soil and nurturing soil and growing soil. By feeding your soil, you are feeding your plants. And that’s what it’s all about.”

OUT VS. IN

When the subject of indoor hydroponic growing came up, Stefano expressed a very strong philosophy. “This is really important, and it’s becoming more and more of an issue,” she said. “Marijuana was illegal for many years—since 1937. And due to that, people couldn’t grow cannabis out in the open, so where did they grow it? In the basement, or in a closet, because that’s the only place that they could hide it. To do that, they had to use artificial lights, and they developed some really good techniques to get really strong, flavorful cannabis that looked great and had high yields.”

But cannabis is a plant and it loves sunshine, nature and soil, and it thrives outdoors. Stefano told me that when cannabis is grown outside correctly, it produces very high-grade terpenes and cannabinoid-rich flowers. “Now that it’s legal in many states, it doesn’t *have* to be grown indoors anymore,” she said. “But because of the history, many people learned how to grow indoors and they got very good at it, and they didn’t want to take the risk to go outdoors.”

And, according to Stefano, it’s a misconception that outdoor cultivation comes with higher risks and big unknowns. The fears of pests and inclement weather damaging crops have kept many growers cultivating indoors in factory warehouses. And growing in these



A row of Dancehall (left), a CBD-rich medical strain, growing right alongside a row of Death Star, a THC-rich recreational strain.

indoor facilities comes with a great cost. “In Washington, there are 30,000-square-foot factories that are using hundreds of thousands of watts of electricity, and the carbon footprint is obscenely high,” Stefano said. It’s been estimated 1 percent of the country’s grid power is being used to grow cannabis—and the percentage in Washington State is even higher.

“Cannabis is a plant that thrives when grown outside in the right environment!” Stefano said. “It produces an amazing array of terpenes and flavors and beautiful flowers. It’s happy and healthy, and you don’t need pesticides because nature provides you with a natural protective system.” Natural predators feast on insects, she said, and the wind provides airflow and prevents fungus from attacking the crop.

Indoor growers, on the other hand, have to meticulously control the environment to prevent fungal infections from taking hold, and insect populations can explode without natural predators around to devour them. This can often lead to the widespread and sometimes illegal use of chemical pesticides.

TERROIR, TERROIR, TERROIR

Stefano and Short also attribute the high quality of their weed to the very first decision they made when they decided to start Puffin Farm: its Yakima River location. “Terroir is a really important concept that people are just starting to consider when it comes to cannabis. It’s what gives wines produced on different estates from the same genetic stock their unique characteristics,” Stefano said. “Terroir is a combination of all the environmental factors that contribute to a crop. It includes things such as elevation, air quality, the UV light that comes to your location, geography, local microclimate, soil characteristics, mineral composition and cultivation practices.

“If you’re next to a river or if there are hills by the farm, that will affect the final character of your crop,” Stefano continues. “Terroir affects what flavors are expressed, the concentrations of cannabinoids and, to some extent, the ratios. We have a stellar terroir that includes a dry, hot summer, a good elevation and river frontage. We get a lot of wind, which is a battle sometimes, but it certainly adds something to the phenotypic expression we see in our crop.

We have a great terroir here in Ellensburg, and it is definitely helping to create aromatic and tasty flower.”

ORGANIC EQUIVALENCY

Although most everything Stefano and Short do on the farm is “organic,” Washington State has no official organic designation for cannabis. As a matter of fact, farms are not actually allowed to call their weed organic regardless of farming practices. “Washington State has explicitly created rules that say you cannot call your cannabis organic,” said Stefano. Nevertheless, she adds, “We grow to organic standards using organically certified amendments. We’ve chosen the Clean Green Certified [Program], which is the largest cannabis organic-equivalent certifier in the country, to vet our farm’s practices. They inspect our farm and look at all the amendments. They take samples for pesticide testing, and make sure there are no synthetic chemicals being used. We believe in the importance of third-party certification because on the market you’ll see many products claiming to be pesticide-free and organic, but there’s nobody verifying that.”

PUFFIN PURPLE

Afghani x G-13 x Seattle Purple

75% *indica*/25% *sativa*

Flowering time: 9-10 weeks

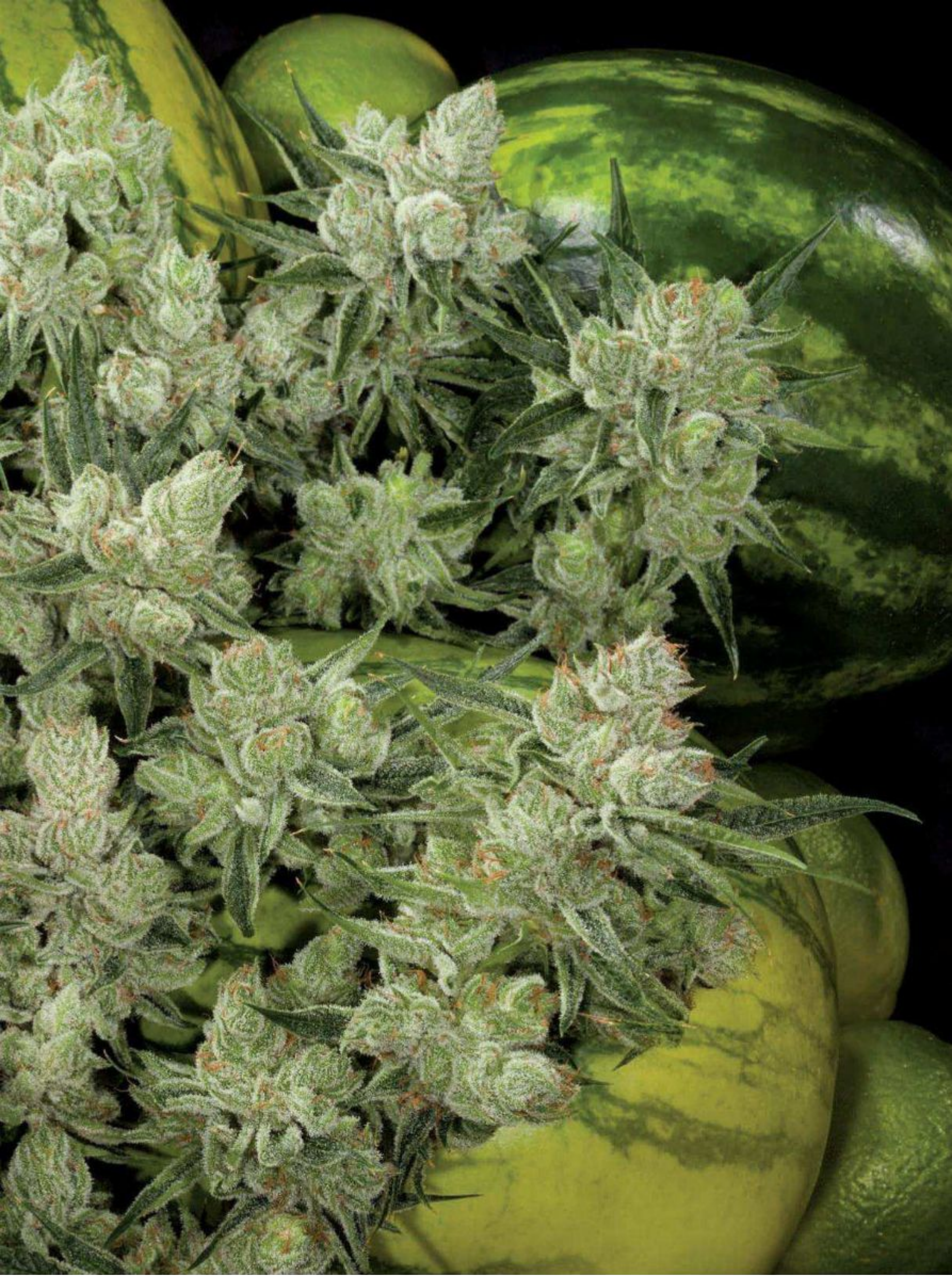
17.1% THC

0.23% CBD





HIGH TIMES
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HINDU KUSH

Clone only landrace *indica*

Flowering time: 8-9 weeks

21% THC

0.13% CBD

3.1% Terpene Total





21% BIGGER YIELDS
55.8% INCREASE IN CBD
42.05% IN THC LEVELS

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During the harvest season the greenhouses are converted into huge drying rooms.

THE POST-HARVEST CURE

As rigid as Stefano's and Short's approach is to pure organic farming, so is their methodology in post-processing. "Growing terpene-rich, cannabinoid-rich plants is one thing—and that takes a lot of effort and the use of the right ingredients—but there's all kinds of ways that stuff can go wrong after harvest, so we take post-harvest care and processing very seriously," Stefano said.

At Puffin Farm, the plants are harvested at their peak, and are quickly brought into climate-controlled rooms in which they're hung upside down with most of their fan leaves and stalks intact. The leaves protect the fragile trichomes from damage as the plants are slowly dried for 14-18 days at a temperature of 70°F or less.

After drying, the curing process begins, which can take anywhere from one to six months, depending on the strain. "Some strains reach their peak after six months or more of proper curing," Stefano said. "We have cannabis

from last year. It's over a year old and it still smells and tastes amazing, and in fact is better than it was a month after harvest. Its flavor becomes smoother and more mature the way a fine wine would. So curing and storage are really important, and temperature and humidity must be carefully controlled."

The cannabis is stored throughout the year in climate-controlled rooms, between 50° and 60°F. With time, flavors improve, the product becomes smoother and terpenes are maintained. "It's like wine in that it will degrade with excess heat and light," Stefano said. "It needs to be handled with care and conscientiousness."

IN TERPENES WE TRUST

Puffin Farm has developed a reputation for producing recreational varieties treasured for their rich and intoxicating aromas and flavors. "We grow the highest quality with the most flavor," Short stated. "We're not necessarily driven by the highest THC content or the biggest

yield or the commercially easy strains. It's more about the terpenes. 'In Terpenes We Trust' is our motto."

He's not kidding. Puffin Farm recently took 11 top awards at TerpeFestival, a terpene festival and competition. But in addition to Tangerine, Lemon OG and Puffin's coveted Hindu Kush—among many other recreational strains—the farm has also made a lot of headway in coming up with several very effective medicinal CBD varieties. Stefano explained: "We had been on a strain hunt for CBD, which we had been learning a lot about, and realized there was a real need for CBD cannabis in the market. So we started growing seeds out from a bunch of different CBD-rich cultivars and testing the flower and searching for strong CBD phenotypes. In that process, we came across three or four amazing ones that we have kept growing and they're truly wonderful!"

And the medicinal efficacy of Puffin Farm's cannabis is self-evident. "There's a patient in Washington State who has intractable seizures and who was having multiple seizures a day that were not being controlled with pharmaceutical drugs," Stefano explained. "The patient found one of the cultivars that we grow, the Remedy, in our clients' retail stores in Seattle. It is one of only two strains that completely stopped the seizures.

"I hear stories like this about our CBD strains and I'm humbled," Stefano continued. "I get emails all the time from patients about another strain we grow called Dancehall. It's a 20:1 CBD to THC as well. These people may have anxiety and pain and are suffering terribly, and they find this strain and it changes their lives and makes them functional again. Stories like this about our CBD products just blow my mind."

The conversation lightened up as Stefano hit the kitchen to whip up a huge salad and a big pot of pasta with home-made marinara sauce, her own version of her family's traditional recipe. She often prepares an impromptu lunch for everyone on the farm. As she cooked, she mused: "You know, it's gratifying to know that our customers appreciate quality as much as we do. It's funny... We've run some numbers and so far we've gotten over a million people high—and counting." 🌿

*Article excerpted from the forthcoming book *A Year in the Life of Puffin Farm*, by David Goodman.*

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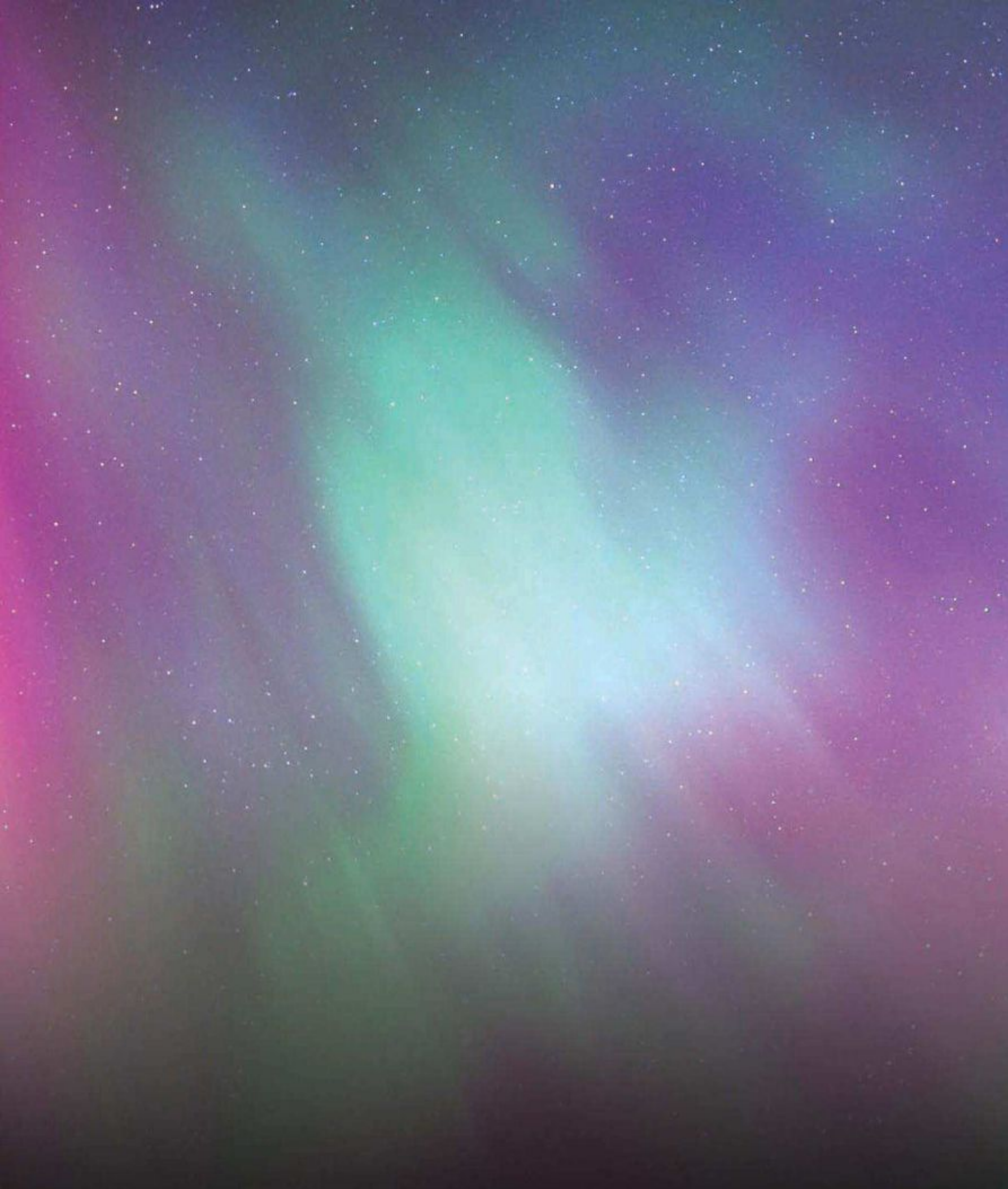
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CANNABIS GENETICS: THE NOT-SO-BASICS OF BREEDING

MORE SO THAN ANY OTHER PLANT, THE BREEDING OF CANNABIS IS BOTH A SCIENCE AND AN ART. BECAUSE OF THE PSYCHOTROPIC EFFECTS OF THE PLANT, BREEDING FOR STRAINS IS MORE THAN JUST ABOUT TASTE, AROMA OR YIELD LIKE IT IS WITH OTHER FLOWERS, FRUITS OR VEGETABLES. IN THIS ARTICLE, WE WILL FOCUS ON THE SCIENCE OF BREEDING AND THE DIFFICULTY IN CREATING TRUE-BREEDING SEEDS THAT EXPRESS THE MOST DESIRABLE TRAITS. *BY NICO ESCONDIDO*



Breeding is not easy, but when done right seeds are the way to go.



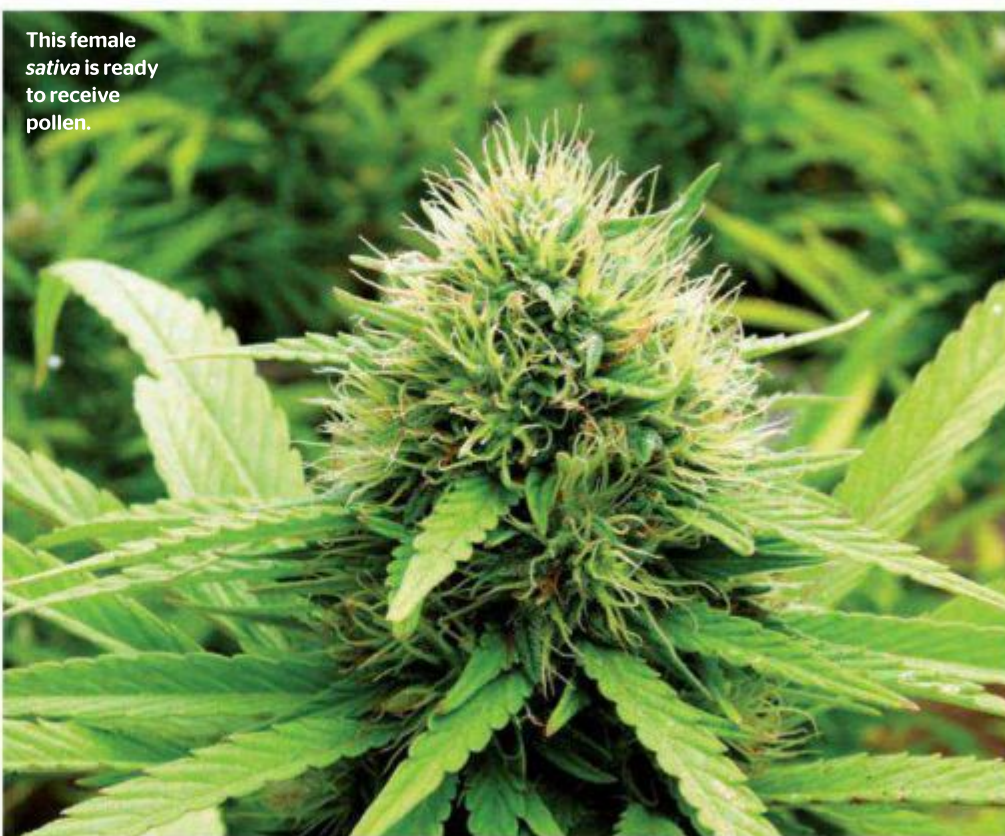
SATIVAS, INDICAS & HYBRIDS

When people talk about genetics and the breeding of cannabis plants, the conversation usually begins with the three primary subspecies of the plant: *C. sativa*, *C. indica* and *C. ruderalis*. These three subspecies are subsets of the species *Cannabis sativa* L. of the genus *Cannabis*, all of which are of the *Cannabaceae* plant family. While *ruderalis* is less a consumable and more of a hardy, hemp-like varietal, both *sativa* and *indica* plants contain high levels of the cannabinoids and terpenes that elicit the varying effects that are the most desirable characteristics of the plant. These characteristics, whether they are related to the psychotropic properties or to the flavors and aromas associated with the flowers, are the driving forces behind cannabis breeding.

Before going any further, it should also be noted that, in terms of the *sativa* and *indica* species, it is unlikely that pure (100 percent) *sativa* and *indica* cannabis exist any longer in any populated locations on earth. Yes, it is possible that certain landrace strains may still be growing in their geographic locations of origin, but even in places such as Afghanistan, India, Thailand, or South and Central America, new cannabis seeds have been brought back to these lands dating as far back as the 1950s and have been planted outdoors by local farmers attempting to make better products such as hashish and bhang. Pollen from new breeds of cannabis genetics have, by this time, proliferated, making it extremely difficult, if possible at all, to find pure landrace genetics, even in the wild.

In theory, landrace strains could produce true-breeding pure genetics in seed form, but such reproductions would still have to be verified using DNA analysis, which is both costly and very time-consuming. In reality, less than 1 percent of the current cannabis gene pool is pure 100 percent *sativa* or *indica*. This means that over 99 percent of all strains out there are technically hybrids.

Of course, this doesn't mean that a hybrid can't be heavily *sativa*- or *indica*-dominant, but most of these strong *sativas* or *indicas* will be closer to a 70-30 or 60-40 split. But this distinction is important to remember because it has direct (and often negative) implications for modern-day breeders (more on this to follow when we get into F generations). It also means that with smart breeding techniques—and the limiting of feminization of seeds—the cannabis gene pool can, theoretically, recoup some of our lost heirloom strains. However, the key word here is *smart* when discussing breeding practices and, as you will soon discover, this world of breeding is anything but simple.



This female *sativa* is ready to receive pollen.

THE F1 GENERATION

When you go to a cannabis shop or event looking for seeds to buy for your home garden and a breeder proudly tells you that all the seeds being sold are F1s, you should think twice about making a purchase. As a home (or commercial) grower, you are looking to buy stable genetics that will represent the strain you are looking for in a consistent and uniform manner. The first-generation cross between two parents of different strains, known as an F1 (or *filial* 1 hybrid), is anything but stable and uniform.

Before we can understand why this is, or even what an F1 hybrid is, we need to first understand a few important terms and concepts from the world of breeding. When we discuss the plant characteristics for which we breed, we need to know which genes (or more specifically, alleles) are homozygous, which are heterozygous, and which are dominant or recessive. To help us with these terms, here are brief definitions of each:

Genes are found in chromosomes which make up DNA. These units control inheritance and are passed on from parent to offspring. Genes are responsible for each specific feature of a plant, such as height, leaf color, aroma and potency.

Gene pairs are the gene sets that are inherited from each parent for each trait. Each pair contains two genes, one from the mother and one from the father. These gene sets are denoted by a pair of letters such as “PP,” “Pp,” “Gg,” “gg,” etc. Capital letters refer to dominant genes, while lowercase letters refer to recessive genes. Cannabis has over 800 million base pairs.

Alleles are alternative forms of one gene.

This is the switch that triggers a specific trait. Because it has two sides, it may have multiple forms—and can be expressed in more than one way within the plant (i.e., “AA,” “aa” or “Aa”).

Homozygous means having identical alleles within a gene set. These traits can be **homozygous-dominant** or **homozygous-recessive**. When mapping out genetic sequences, the gene sets would look like “MM” for dominant traits or “mm” for recessive traits.

Heterozygous means having differing alleles within a gene set. Heterozygous traits are neither dominant (“DD”) nor recessive (“dd”), but rather look like “Dd” when written.

Next, let's look at a specific method for mapping out or predicting the outcome of a particular breeding project. This matrix, named after the plant scientist who developed it, Reginald C. Punnett, is known as the Punnett Square and uses a rudimentary chart to plot combinations of gene sets and the results of their crossing.

Understanding not only what traits from each parent are being crossed, but also whether these traits are homozygous-dominant, homozygous-recessive or heterozygous, is essential to the accuracy of the predicted results. In these instances, “dominant” is used to describe a gene or allele that is expressed even when the trait is inherited from only one parent. “Recessive” is used to describe a gene or allele that will be expressed only in homozygotes—or when both parents have the same exact recessive trait. A recessive trait would be masked even by a heterozygous gene set or cross.



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Once we have this basic understanding, we can begin to play around with predictive tools, such as the Punnett Square. As an example, let's say we have two parent plants from which to make a cross. For the sake of simplicity, let's say that one parent is homozygous-dominant for deep purple flowers ("PP"), while the other parent is homozygous-dominant for light green flowers ("GG"). Using the Punnett Square, we can map out and predict the outcome of the offspring in Figure 1.

FIGURE 1

	P	P
G	PG	PG
G	PG	PG

Now imagine that you are back at the seed shop attempting to buy the seeds of a purple strain that just won the Cannabis Cup. And like most strains these days, it was a clone-only strain with deep purple buds. But the grower had to cross it with something to make seeds for sale. Had the grower crossed it with a strain that was homozygous-dominant for light green as in Figure 1, the outcome would have been disappointing, with 100 percent of the seeds being a purple-green hybrid in the F1 generation. None of the offspring would exhibit that alluring deep purple that made the bud so unique, but instead would have a 50-50 mix of purple and green leaves within the buds. And while this may appear to not be the worst outcome in the world—after all, some purple would show in the buds—imagine if the trait being bred for was not color but flavor or high and the outcome was a combination of the two. That would result in an even worse outcome.

Hopefully, the breeder was smarter than that and used another homozygous-dominant purple parent, for which the outcome would have 100 percent of the offspring being deep-purple-dominant and would look like Figure 2.

FIGURE 2

	P	P
P	PP	PP
P	PP	PP

And while this should, in theory, replicate the deep-purple color represented in the Cup-winning strain, we must remember that this is only one trait being expressed by the parents out of dozens. So while the breeder might succeed in getting the same color in the offspring, matching the two parents up to replicate a dozen other traits from the Cup-winning parent (e.g., the same flavors, aromas, potency levels or even yields) would be a much, much tougher project. (Note: See the last section of this article to understand how other variations are inevitable as well.)



A male plant with pollen sacs starting to open.

However, with smart breeding practices, some patience and a lot of time, there are ways for growers to replicate their prized genetics—though these seeds would not be anywhere close to the first-generation (F1) cross and would not be able to appear on the market for several years after a particular strain won the coveted Cup prize (assuming breeding for stable seeds starts after the competition). Instead, through high-volume parent selections and multiple generations of crosses and backcrossing projects, eventually a breeder can arrive at the desired likeness of a strain with the stability and consistency that seed buyers are looking for. So when someone tells you that you are buying F1s or F2s of something, unless you are a breeder yourself looking for that surprise mutation, what you really want is something more along the lines of an F6- or F7-generation seed.

HOMOZYGOUS VS. HETEROZYGOUS

Here comes the real tricky part. How do you determine which strains are homozygous and which are heterozygous? And more importantly, once you know a strain is homozygous, how do you determine whether a trait will be dominant or recessive?

In figuring this out, you must first do a series of pre-breeding experiments—that is, before you get to the real breeding project of making stable seeds of your desired traits. Again, this is why it takes reputable breeders years to create true-breeding seeds that are dominant for the desired traits of a particular strain.

To start, a breeder must first determine whether a strain is homozygous or heterozygous for a specific trait. For a strain to be homozygous, its gene pair for a given trait would be designated "BB" or "bb." A heterozygous trait would be "Bb."

Generally, where a gene set exists in two allelic versions (designated "A" and "a"), three combinations of alleles are possible: "AA," "Aa" and "aa." If "AA" and "aa" individuals (homozygotes) show different forms of the same trait (i.e., phenotypes), and "Aa" individuals (heterozygotes) show the same phenotype as "AA" individuals, then allele "A" is said to be dominant to allele "a," and "a" is said to be recessive to "A." To do this, the breeder must first find the two homozygote parents that have opposing expressions for the same trait. The breeder then does a test cross of the two parents and compares the results in the heterozygous offspring to those traits displayed in the parents to determine dominance in this way.

Additionally, having even one previously known trait designation can be extremely helpful. For example, if the breeder knows that one parent is homozygous-recessive or heterozygous for the same trait being tested for, they can then cross any suspected homozygous-dominant parent of the same trait with the recessive strain to test the theory (and vice versa). If the second parent being tested is actually homozygous-dominant for a trait, that trait will appear in nearly all the offspring (with slight variations), showing that the second parent is dominant for that trait. This may take several crossings with several different mates to ensure the trait is dominant in that particular strain, and this can take

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anywhere from six months to two years, depending on the space available to grow the multiple crosses and how many test crosses the breeder feels is needed.

You might ask how the breeder first knew the first parent was recessive to use in this testing. Many breeders will have breeding stock on hand that they have worked with for years and know how to designate each of their traits for testing purposes. Otherwise, they may choose to use a benign strain that exhibited no dominance when crossed with strains in the past. The only real way to determine these designations is through time and crossbreeding. Even with today's complex DNA analysis, the testing, comparisons and analysis can take multiple years because the catalog of known and recorded DNA tests is still in its infancy for cannabis, and these tests rely on comparisons between DNA strains to determine which markers in DNA are equal to dominant and recessive traits.

THE TRUTH ABOUT 'SEED COMPANIES'

The truth is that many companies that market themselves as seed companies do not do any of the actual breeding described above. At least not to the extent that it can be called breeding, but rather a watered-down process of seed replication.

Those in the know refer to this crude and deceiving practice as "pollen chucking," which is to say growers take a female clone-only strain that they like (or won a prize with) and attempt to replicate it by simply throwing male pollen on it in order to produce seeds. Many times, there is no attempt on the part of the breeder to identify traits as dominant or recessive, let alone homozygous or heterozygous. (In fact, if you ask some of these "breeders" what those terms mean, you'll likely get a blank stare.) Only a fraction of the F1 seeds produced will come close to the intended target of the original mother.

Still, these dubious entrepreneurs market these new knockoffs as the real deal, keeping the strain name of the mother plant intact, even though most of the seeds in the packet may be nothing like it once grown out. And so goes the cannabis seed trade—buyer beware.

Upon closer inspection of the High Times Cannabis Cup competition data that spans nearly a decade, it was calculated that more than half the participants (numbering in the thousands) were unable (or unwilling) to identify the lineage of the strains being entered into the competition. Of course, not all the competitors proffer themselves as seed companies, but still it is a seemingly odd occurrence given the focus of these companies. Though it should also be noted that some may have omitted this information in order to protect their own intellectual property. Still, it makes us wonder and does not inspire confidence.

F2S & BEYOND

To fully understand the generational outcomes of each successive cross of two plant generations, we must rely on our knowledge of the aforementioned definitions. For example, it is essential to understand that both a homozygous-dominant parent and a heterozygous parent can be dominant for the same trait. However, when matched with another parent, the homozygous-dominant plant will almost always produce offspring that exemplifies the dominant trait—unless that parent is dominant for the opposite, in which case the offspring will show both traits (e.g., two colors on the same plant, with slight variation in frequency).

However, if one parent is heterozygous, the outcome is less certain and depends a lot on the makeup of the second parent. While the dominant trait of the heterozygous parent will still appear, its frequency will be much less. It is this frequency of expression that is of interest to breeders—and to us in understanding subsequent generations (F2, F3, etc.) of plant offspring. Let's look at an example.

If we have two parents, one homozygous-dominant for being tall ("DD") and one homozygous-recessive for being dwarf-size ("dd") and cross the two, the parental generation will create an F1 generation that are all heterozygous ("Dd"), as seen in Figure 3. In this scenario, the stability of the offspring will vary, meaning that dominance is not inherent to either an allele or its phenotype. The relationship between the two alleles in this new gene set ("Dd") might be that the first allele is dominant over the second allele (highest frequency), co-dominant (medium frequency) or recessive (least frequent and rare).

FIGURE 3

	D	D
d	Dd	Dd
d	Dd	Dd

At first glance, this looks pretty good. Four out of four offspring will be heterozygous and should demonstrate tall height because one parent was homozygous-dominant.

However, as we first discussed in this article, nearly all strains in today's market—especially the coveted clone-only strains that many people are trying to replicate via breeding—are hybrids and, in reality, are already an F1 or F2 generation (maybe even later). So when we take a more realistic look at our Punnett Square and redo the matrix using two heterozygous hybrids (Figure 4), the outlook is much less attractive.

FIGURE 4

	D	d
D	DD	Dd
d	Dd	dd

On the surface, it appears that in this "F1" generation (which is more likely an unstable F3), we have an outcome of three tall plants (one "DD" and two "Dd"). However, the wrench in the works here is a principle known as the Hardy-Weinberg Law of Genetic Equilibrium. The Hardy-Weinberg Law is a model or equation that demonstrates how variation works and affects the frequency of the heterozygous state—in this case, the "Dd" offspring.

First, it should be understood that when making these calculations, such as using a Punnett Square or applying the Hardy-Weinberg Law, large populations of seedlings need to be propagated in order for these principles to bear accuracy. This means that simply growing out 10 or so seeds to test a new cross generation is not enough. Rather, a real seedling population would be more on the order of 1,000 germinated seeds (keeping in mind half will be male).

For the sake of brevity, we will accept the principle's equation of $p^2 + 2pq + q^2 = 100$, where

p = the frequency of the dominant allele in the population,

q = the frequency of the recessive allele in the population,

p^2 = the percentage of homozygous-dominant offspring,

q^2 = the percentage of homozygous-recessive offspring,

$2pq$ = the percentage of heterozygous offspring.

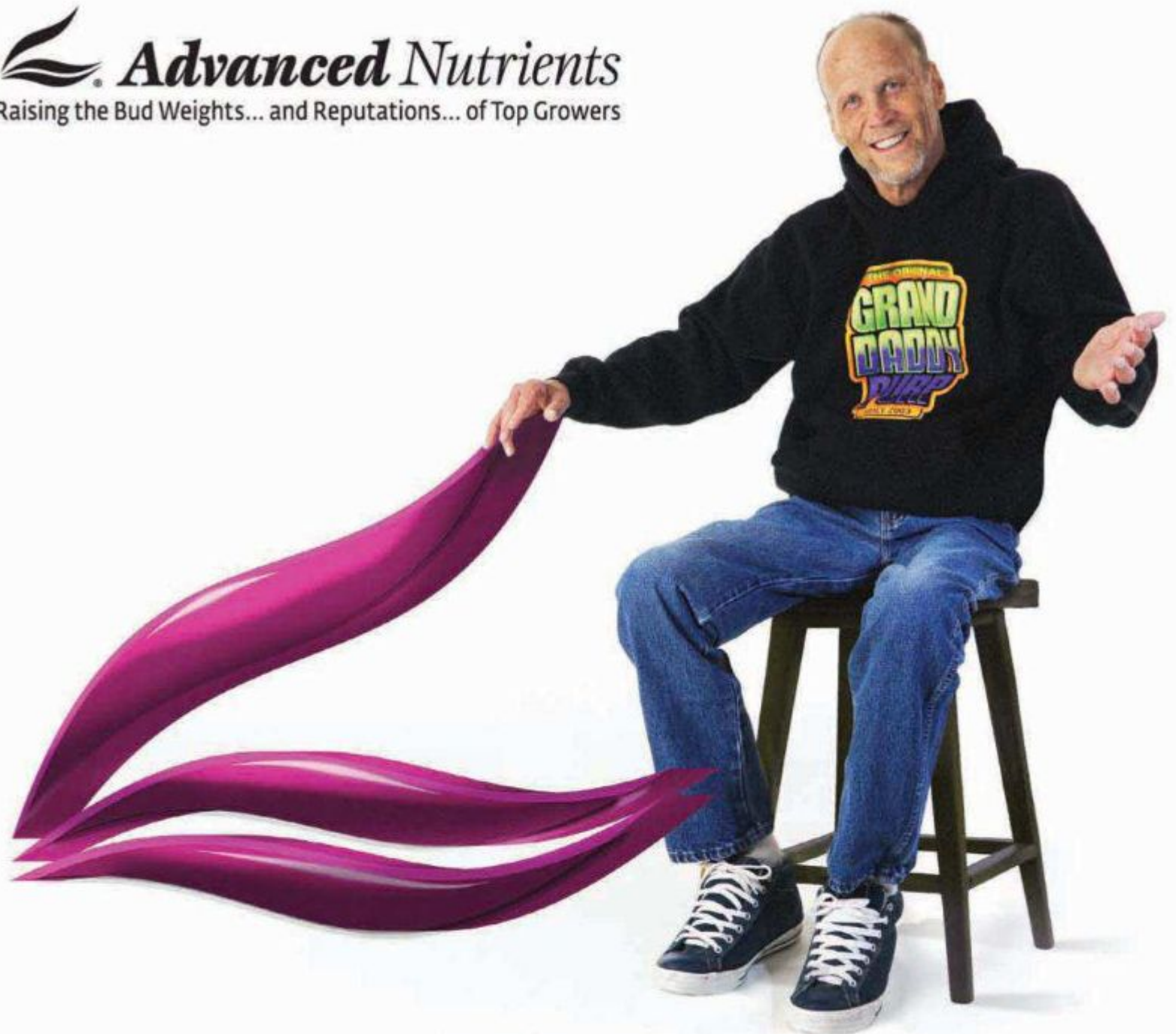
Assuming that a large seedling population is propagated using the gene sets from the two heterozygous parents from Figure 4, we find out that the frequency is not at 75 percent for the tall trait. In fact, using the Hardy-Weinberg Law, we find that the frequency for "DD" is only 16 percent, while the frequency for "Dd" is 48 percent and the frequency for "dd" is actually 36 percent. So, at best, the frequency for tall plants is 64 percent, and that is assuming that all 48 percent of the heterozygotes express themselves as tall, which is not necessarily a given when you think about how phenotypes express themselves depending on their environment.

With the equation $phenotype = genotype + environment$, we know that in a heterozygote ("Dd") the dominant allele may not always mask the recessive allele, as natural selection

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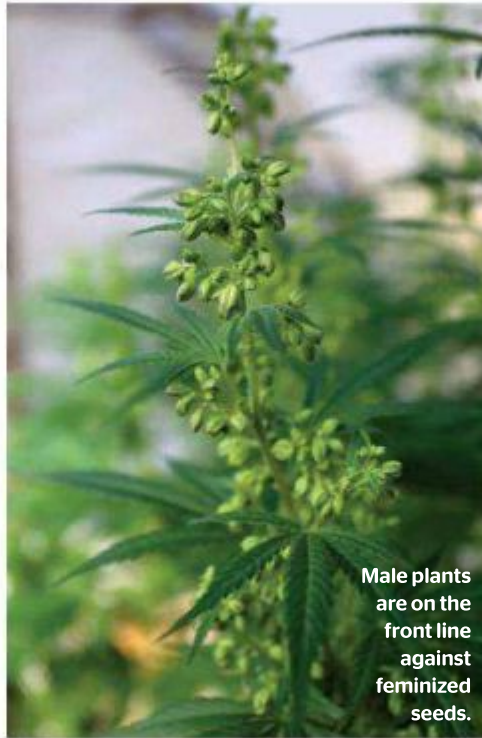


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allows for plants to evolve and adapt to their environment. But in this case, the best scenario would be that out of a pack of 10 non-feminized seeds, one seed would produce a tall female plant, one seed would produce a dwarf female plant and two seeds would produce heterozygous plants that might be tall or might be dwarf. The other five seeds would be male, assuming a 50-50 male-female ratio. For a \$300 pack of seeds, those aren't the best odds of getting what you want.

This is a primary reason many breeders feminize their seeds these days, as it gives the buyer better odds of getting the expected traits. But the truth is that if the breeding was done correctly to start with, there would be less need to feminize seeds in order to satisfy customers, and the cannabis gene pool would not suffer for the sake of sales.

Moving forward, if we take the offspring and make subsequent backcrosses to the parents, breeders can really start to hone in on the desired traits and increase the frequency that they appear—and, therefore, the stability and uniformity of the seeds. Growing out another large population of the offspring and selecting for the desired dominant traits and then backcrossing to the original parent with those same dominant traits will eventually yield a true-breeding strain that expresses



Male plants are on the front line against feminized seeds.

IF MORE BREEDING WAS DONE CORRECTLY, THERE WOULD BE NO NEED TO FEMINIZE SEEDS AND THE CANNABIS GENE POOL WOULD NOT BE SUFFERING.

those traits over 90 percent of the time. Using the tools discussed in this article, we can estimate that around the F5-F7 generations a large majority of the offspring will steadily exhibit the traits bred for at very high ratios. Of course, the catch is that this could easily take three years (or more) of smart breeding practices to correctly achieve, especially when doing it correctly means not cutting corners by self-pollination and seed feminization.

NOT AN EXACT SCIENCE

One last note of importance is that we must remember that nature is always in control. Despite our best efforts and formulaic resources, in the due course of breeding things may not go our way. As perplexing as this may seem, we must understand and respect the fact that because of the nature of genetic material, the independent assortment of chromosomes and the chance recombination during fertilization, varying patterns of genetic variation will appear in seedling populations. This means that, for natural reasons, even the best breeders and the stringent efforts they make may not yield the seeds we expect. It's a finicky world of breeding, but all we can do is breed smart and breed the right way. Future generations of cannabis users will thank us for it someday. 🌿

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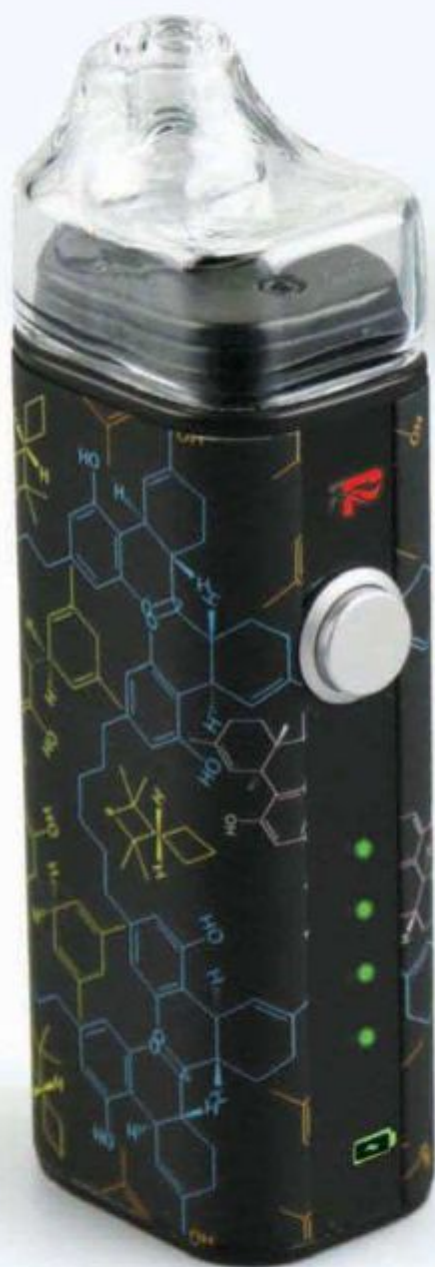
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THE GREAT TERPENE SWINDLE

WHEN IT COMES TO MARIJUANA CONCENTRATES THAT EXPRESS THE PLANT'S TRUE ESSENCE, THERE'S A BIG DIFFERENCE BETWEEN THOSE PRODUCED BY COLD-SOLVENT EXTRACTION AND HEATED-WATER OR STEAM DISTILLATION. BY KENNETH MORROW, TRICHOME TECHNOLOGIES

BEWARE! ALL THAT glitters is not gold, and some of the cannabis-derived “terpenes” being sold to the public are not what consumers—or manufacturers—think they are. In fact, they’re actually classified as hydrosols, which are not pure cannabis terpenes in composition. Rather, they’re a product produced from distillation, as are most true essential oils.

There are multiple distillation processes used, but in all of them water is heated to produce steam, which extracts the most volatile chemicals and essential oils of the plant. The steam is then cooled in a condenser and the resulting distillate is collected. Whether using steam or hydro distillation, or a combination of the two, the resulting hydrosols are basically the same.

Steam distillation is the most efficient and versatile form of distillation. For an in-depth explanation of this process, see Martin Watt’s article “Hydrosols or Distillation Waters: Their Production, Safety, Efficacy and the Sales Hype.”

HEAT DEGRADES

Although many oils are produced by steam distillation, those that are all lack the vibrancy of oils collected via processes in which they are not subjected to heat. One of the many disadvantages of water or steam distillation is the presence of oxygenated compounds such as phenols. Phenols have a tendency to

dissolve in this still water (the water used in distillation apparatus), so it’s impossible to completely remove them through distillation. Furthermore, essential oils with high solubility in water and those susceptible to damage by heat cannot be steam-distilled. All the compounds must also be steam-volatile for steam or water distillation to be feasible. Therefore, essential oils obtained by distillation do not accurately match the natural oils originally occurring in the plant material.

The main disadvantages of steam or water distillation are that complete extraction is not possible and that certain esters are only partly hydrolyzed, while sensitive substances like aldehydes tend to polymerize. The proper extraction of essential oils is only feasible by the process of mechanical pressing (expression) or solvent extraction.

Before discussing the basic principles of essential-oil production, it is important to understand that the essential oils are not necessarily identical to what’s present in the plant. With a few rare exceptions, it is wishful thinking to consider an essential oil to be “the soul” of a plant and thus an exact replica of what is present in that plant. Only expressed oils that have not come in contact with heat or oxidation may meet the conditions of a true essential oil. A distilled essential oil’s chemical composition isn’t the same as the chemical composition of a plant growing in its natural environment.





A great example is rose oil. A layperson examining pure, natural rose oil, even a distillate, will not be able to identify its plant source. The alterations caused by hydro distillation are remarkable, because when the plant material comes into contact with steam, it undergoes many chemical changes. Steam will cause decomposition, and aldehydes and esters may be formed from acids generated during the vaporization of certain essential-oil components. Some water-soluble molecules may be lost in solution to the still water, thus altering the fragrance profile of the oil.

FLORAL WATERS

To break it down further, herbal distillates—also called floral water, hydrosol, hydrolate, herbal water and essential water—are aqueous products of distillation. They are colloidal suspensions (hydrosols) of essential oils as well as water-soluble components obtained by steam or hydro distillation from plants and herbs. Distillates are used for flavorings and in pharmaceuticals and cosmetics. Herbal distillates are produced by the same or similar methods used to produce essential oils, but the appropriate term for the resulting product, essential water, is more descriptive.

In the past, these essential waters were considered a by-product of distillation, but they are now considered co-products. The science of distillation is based on the fact that different compounds vaporize at different temperatures. Unlike other extraction techniques based on the solubility of a compound in either oil or water, distillation separates components regardless of their solubility. The resulting distillate will contain compounds that vaporize at or below the temperature of distillation. The actual chemical components of distillates have not yet been fully identified, but they will include some essential-oil compounds as well as organic acids and other water-soluble plant compounds.

KENNETH MORROW

Compounds with higher boiling points will remain behind, including many water-soluble plant pigments and flavonoids. Herbal waters contain diluted essential oils. In addition to aromatic chemicals, these distillates also contain many more plant acids than pure essential oils, making them skin-friendly.

Cosmetics and toiletries manufacturers have found many uses for herbal distillates, but floral water (hydrosols) may be unfit for human consumption via inhalation. I advise against vaporizing, smoking or dabbing hydrosols.

TERPENE TECH

Terpenes are natural compounds found in many organisms throughout the animal and plant kingdoms. They comprise the largest class of natural products, with 755,000 known structurally diverse compounds. Multiple studies have attributed to this big family of compounds a large range of pharmacological properties, such as anticancer, antimicrobial, antifungal, antiviral, antihyperglycemic, analgesic, anti-inflammatory and antiparasitic qualities. A diversity of natural products derived from plants has been an important source of medicinal products for millennia.

Effective drug development depends on multidisciplinary collaborations, such as those between botanical, phytochemical and biological disciplines. Worldwide sales of terpene patent-based pharmaceuticals in 2002 were approximately \$12 billion. With the real medicinal value of cannabis compounds such as cannabinoids and terpenoids just beginning to be explored, I expect a multibillion-dollar cannabis pharmaceutical industry to emerge someday.

CANNABIS COMPONENTS

In “Chemistry and Analysis of Phytocannabinoids and Other *Cannabis* Constituents,” Dr. Rudolf Brenneisen of the University of Bern states that there are 483 identified compounds unique to cannabis, including more than 60 cannabinoids and over 140 different terpenes. In “The Volatile Oil Composition of Fresh and Air-Dried Buds of *Cannabis sativa*,” Drs. Samir A. Ross and Mahmoud A. ElSohly of the University of Mississippi present data showing that fresh bud oil is composed mainly of monoterpenes (92 percent) and sesquiterpenes (7 percent), with approximately 1 percent other chemical classes such as simple ketones and esters. The two principal monoterpene components are β -myrcene and

limonene (67 percent and 16 percent, respectively). Of the 68 components detected in a chromatogram of fresh bud oil, 57 were identified. These include two hydrocarbon ketones, one aliphatic alcohol ester, 23 monoterpenes and 31 sesquiterpenes. Three of the identified monoterpenes and 14 of the sesquiterpenes have not been reported previously in cannabis odor or volatile oil.

Not unexpectedly, drying the plant material resulted in an overall reduction in the percentage of the oil recovered, with most of the loss appearing to take place during the first week of drying. This results in a significantly greater loss of monoterpenes than sesquiterpenes.

TERPENES ARE NATURAL COMPOUNDS FOUND IN MANY ORGANISMS THROUGHOUT THE ANIMAL AND PLANT KINGDOMS. THEY COMPRISE THE LARGEST CLASS OF NATURAL PRODUCTS, WITH 755,000 KNOWN STRUCTURALLY DIVERSE COMPOUNDS.

However, qualitatively speaking, none of the major components of the oil (70 percent of the total) completely disappeared in the drying process.

All this depends, however, on the composition of the starting material, the extraction methods performed and the analytical methods utilized. The above examples were all the result of research in which subpar government-grown or -seized cannabis was used, and the extraction methods and analysis typically involved heat application of some sort—all of which affect the final percentages of compounds.

I suspect the percentages would be very different if modern-day cultivars were examined, an extraction method was used that didn’t involve heat and modern analytical methods (also not involving heat application) were applied.

EXTRACTION VS. DISTILLATION

The chief advantage of extraction over distillation is that a uniform temperature can be maintained during the process. As a result, extracted oils have a more natural odor unmatched by distilled oils. For example, some very delicate aromatics, such as jasmine and linden blossom, cannot survive the process of distillation. To capture their magical aromas, a process of solvent extraction is used.

The most aromatic extractions occur at or below ambient temperatures. Hence, there is no thermal degradation of the compounds. The solvent-extraction

process utilizes the selectivity of the solvent with no heat application, oxidation, degradation conversion or destruction of the original composition.

The term “distillation” is derived from the Latin word *distillare*, which means “trickling down.” In its simplest form, distillation is defined as “evaporation and subsequent condensation of a liquid,” and typically produces “artifacts of the original composition” caused by oxidation, thermal degradation (i.e., heat), chemical degradation and chemical conversion. The term “essential oil” is a contraction of the original “quintessential oil.”

This stems from the Aristotelian idea

that matter is composed of four elements, namely fire, air, earth and water. The fifth element, or quintessence, was then considered to be the “spirit” or “life force.” Distillation and evaporation were thought to be processes of removing this quintessence from the plant. This is also reflected in our language—the term “spirits” is used to describe distilled alcoholic beverages such as whiskey and eau-de-vie (“water of life,” in French, or, more commonly, brandy), the latter making reference to the concept of extracting the “life force” from the plant.

Today, of course, we know that far from being spirit, essential oils are physical in nature and composed of complex mixtures of chemicals. But one thing retained from the ancient concept of quintessence is that the chemical components of essential oils must be volatile, since they are extracted via distillation. The major prerequisite of the process used for production of essential oils is that the product obtained must resemble the natural aroma and flavor of the original source, which is a combination of different compounds of varying organoleptic characteristics. Oxygenated organic compounds like aldehydes, ketones, alcohols and esters must be in same proportion as in the original natural product in order to match aroma and flavor. For example, rose oil obtained via steam distillation contains sixty times less phenylethyl alcohol (PEA) than rose oil obtained via solvent extraction.



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The typical yield of essential oils from plants is between 0.005 and 10 percent. Elevated temperatures and prolonged extraction times can cause chemical modifications to the essential-oil components and often the loss of the most volatile molecules. “Character-impact odorants” in essential oils are of particular interest to the perfume and flavor industries. Gas chromatography can detect and identify the volatile components, but cannot determine aroma-impact compounds and their odors.

ARE HYDROSOLS SAFE TO INHALE?

From all the above, one can clearly surmise that the extracts of cannabis, both cannabinoids and terpenes, are very complex, that very little is known regarding consumption in concentrated form and that cold-solvent extraction yields far superior products than steam- or hydro-distillation methods with respect to terpene extraction, isolation and preservation. Furthermore, we surmise that pure cannabis-derived terpenes are far superior products than simple hydrosols or floral water. Hydrosols, again, may not be suitable for heated inhalation.

That being said, I have yet to find correlating data that unequivocally indicate that elevated/concentrated levels of terpenes are healthy to inhale. How much is too much? What is the toxic threshold of each? And what is the combined threshold? These questions are in regards to pure terpenes, not hydrosols, which contain only small percentages of terpenes, as stated above.

It should be possible to relate the intake of high doses of the substances to observed toxicity. No attempt has yet been made to evaluate the safety of a natural product based on its chemical composition and the variability of that composition for the intended use. The chemical constitution of a natural product is fundamental to understanding the product’s intended use and factors affecting its safety.

Recent advances in analytical methodology have made the intensive investigation of the chemical composition of a natural product economically feasible and even routine. In fact, analytical tools needed to chemically characterize these complex mixtures are becoming more cost-effective, while the cost of traditional toxicology is becoming more cost-intensive.

Based on the wealth of existing chemical and biological data on the

constituents of essential oils and similar data on essential oils themselves, it is possible to validate a constituent-based safety evaluation of an essential oil. As noted above, it is scientifically valid to evaluate the safety of a natural mixture based on its chemical composition. Fundamentally, it is the interaction between one or more molecules in the natural product and macromolecules, proteins, enzymes, etc., that yield the biological response, regardless of whether it is a desired functional effect such as a pleasing taste or a potential toxic effect such as liver necrosis.

Regarding most of the “terpenes” available today, there are multiple forms:

FURTHERMORE, WE SURMISE THAT PURE CANNABIS-DERIVED TERPENES ARE FAR SUPERIOR PRODUCTS THAN SIMPLE HYDROSOLS OR FLORAL WATER. HYDROSOLS, AGAIN, MAY NOT BE SUITABLE FOR HEATED INHALATION.

1. Organic food-grade terpenes (from plants and fruits)
2. CO₂-extracted fractionalized terpenes (from cannabis)
3. Steam-, hydro- and steam/hydro-distilled terpenes (from cannabis)
4. Thin-film-distilled terpenes (from cannabis)

The respective problems with all of these methods of terpene extraction and isolation vary:

1. As of yet, it is impossible to re-create the odor and flavor of the plethora of cannabis cultivars/cultigens utilizing a small number of available food-grade terpenes, given that there are over 140 terpenes in cannabis. And it’s fair to ask how many of these food-grade terpenes are safe and healthy to inhale (and at what parts per million). What are their toxicity thresholds—separately or combined? The data do not exist regarding inhalation.

2. The CO₂-extraction process typically utilizes dried plant material, in which a percentage of terpenes is lost to evaporation before the dry material is extracted using pressurized CO₂. Any remaining moisture in the plant material contributes to the formation of carbonic acid and a phenol, an aromatic organic compound which tends to homogenize the odor and flavor of whatever terpenes remain. Some extractors super-dry their material, destroying and evaporating even more terpenes.

3. Steam and/or hydro distillates are not whole-terpene compositions. Some

are simply hydrosols being sold for \$10 per drop. These contain minimal percentages of terpenes and only a small percentage of the available 140-plus terpenes available in cannabis. And they produce degraded, converted artifacts of the original terpene composition from the original plant material, which includes any true distilled terpenes as well.

4. Thin-film-distillation units can process and distill many forms of extracts, ranging from cold-fluid, CO₂, and ethanol extracts, and so on. But terpenes are lost and converted by heat in this distillation process, creating artifacts and fractions. Therefore, it is impossible to produce a

distillate that has the exact same odor and flavor of the original plant material.

From all substantiated data above, one can surmise that cold-solvent extraction (i.e., the cold expression of fresh, undried plant material) produces the highest-quality terpene extracts, and that distillates, hydrosols and formulations of a few food-grade terpenes cannot—and can never—completely re-create the flavor or odor of the original composition of living plants. A mixture of many cannabis terpenes has a specific and distinct color tone. Purified compounds and mixtures of a few terpenes can be clear in color, but mixtures of many terpenes contain color. They are not clear like hydrosols or floral waters. Many factors determine this color, but there is always at least a slight hue.

The most disturbing issue regarding the sale, formulation and heated inhalation of concentrated compounds (i.e., essential oils and hydrosols) is that there are no correlating data supporting either a benefit or disadvantage in their use regarding inhalation at elevated temperatures in part or as a whole composition of a matrix of terpenes. A healthy threshold must be established. Those who are dabbing or inhaling hydrosols for which they pay \$10 a drop are being used as test subjects.

And to that I say to the unfortunate consumers of the modern-day terpenes slingers the immortal words of Johnny Rotten: “Ever get the feeling you’ve been cheated?” ✨

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BY MIKE GIANAKOS

PETER FONDA

THE HIGHTIMES INTERVIEW

PETER FONDA JOINED THE FAMILY BUSINESS EARLY ON—HIS FATHER HENRY AND SISTER JANE ARE ACCOMPLISHED ACTORS, NOT TO MENTION HIS DAUGHTER BRIDGET—BUT HE MANAGED TO CARVE OUT HIS OWN NICHE BY MARCHING TO HIS OWN DRUM. THIS HAS RESULTED IN COUNTERCULTURE CLASSICS (*EASY RIDER*, *THE TRIP*), WESTERNS (*THE HIRED HAND*) AND A POWERFUL, OSCAR-NOMINATED PERFORMANCE (*ULEE'S GOLD*). IN HIS LATEST EFFORT, FONDA JOINS CHRISTOPHER PLUMMER AND VERA FARMIGA FOR THE MARIJUANA-FUELED *BOUNDARIES*. *HIGH TIMES* SAT DOWN WITH FONDA TO DISCUSS HIS FILM WORK, THE ENVIRONMENT AND THE CURRENT STATE OF CANNABIS IN AMERICA.

Boundaries is a road-trip film and you play a marijuana enthusiast. Are you concerned at all about getting typecast?

Oh, no, not at all [*laughs*]. I'm not going to get typecast. Let's see... I didn't smoke pot when I was Ulee [in 1997's *Ulee's Gold*]. Of course, I did in *Easy Rider*, *Wild Angels*, *The Trip*... I remember five or six with smoking, but I am a big fan of marijuana. I'm a big fan of the CBD oil. It's amazing. I have a friend who has pain in his legs and his feet from diabetes. He's on pain meds. I gave him some of the CBD oil, and he hasn't touched his pain pills.

It's helping so many people.

Yeah, so the fact that the feds are still attacking it, it's flat bullshit. It's a healing thing. There's so many different things that are good about pot for a person. It's about time we stopped this attitude.

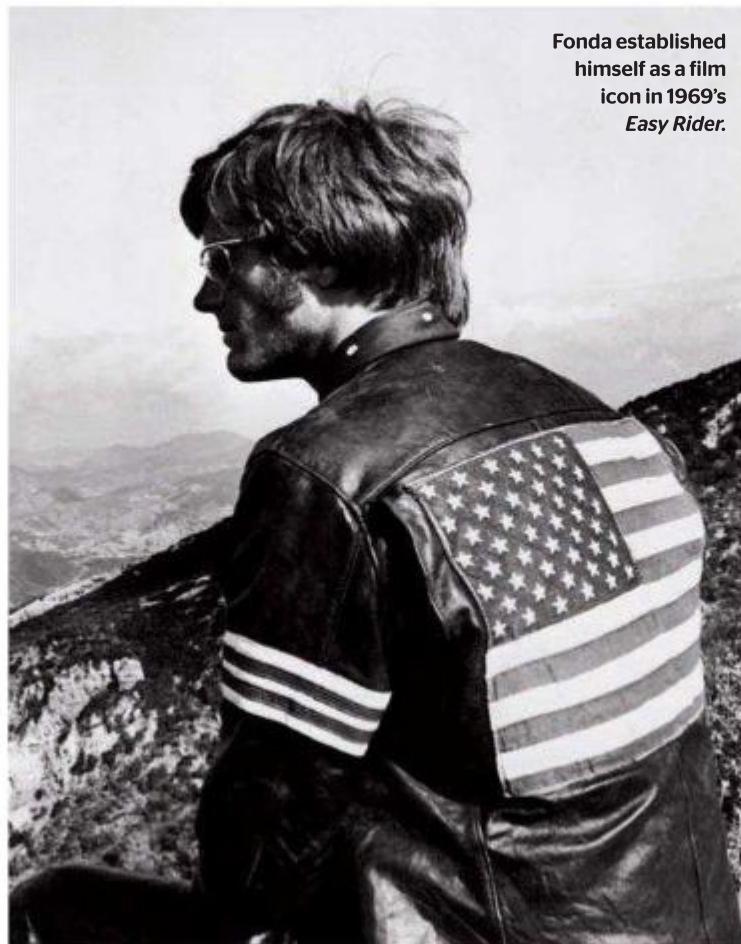
It started when they wanted to outlaw hemp. Nothing to do with the drug. They just wanted to outlaw hemp so they could make paper. But when you make hemp paper, when you recycle it, all you do is add a little starch to make it thicker, you know? There's just so many things [cannabis and hemp provide]—oil, clothes, great medicine. It's amazing.

I noticed that you're vaping in your pot-smoking scene in *Boundaries*. Was that a directorial choice or is that something you personally enjoy?

Well, I've tried a Volcano. That's a big bag of stuff there. And the problem with some of the pens or those little vape pipes is it's too harsh on me. I don't know why. I just have to be careful. And right now, I'm just enjoying the oil. It's just good stuff.

How was it working with Christopher Plummer, who's enjoying quite a late-career resurgence?

I first met Christopher



Fonda established himself as a film icon in 1969's *Easy Rider*.

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when I was 18. So I've known him a while, and the thing is I was able to use that. Chris and I were able to use that, so we were very funny together, and that really helped the situation in the film. You know, Christopher and I just did a lot of laughing. We were there in the old days, so to speak. I was the kid. He's 10 years older than I am. But it was fun, being able to do that. We were down there just vaping away in the film, you know, and we get held up. The director said, "Just go where you want with it," which is wonderful if you know what you're doing. So the [robbers] yell, "Where's the money? Where's the dope?" And finally—we'd done a number of takes on it—I said, "Well, how should I know? I'm stoned?" It was just like, it was perfect. We had a good time doing it. And Vera

Farmiga, what an actor. She's so dynamic, and she has a great sense of humor.

Your most famous pot-smoking scene is in *Easy Rider*—

Yeah, "Here, George, try some of this."

Right. The campfire scene where you turn George [Jack Nicholson] on to pot. That scene is so ahead of its time because it implies that pot's a safe alternative to alcohol, which George struggles with, and it also undercuts the whole "gateway theory." Those views couldn't have been too commonplace at the time.

No. You know what? I had come to my father's house [legendary actor Henry Fonda]—I just dropped in on him, and they're having a business meeting, and I was in jeans and a wrangler

shirt. Walk in and say hi to the people, and they're lawyer types and business types. And one said to me [about marijuana], "You know, just because you don't agree with the law doesn't give you a right to break the law." And I said, "Really? Did you know that on the books of law in California, it's illegal to have oral copulation? But you all practice that all the time. You don't agree with that." They knew they did that, and they knew it was against the law. Those laws are stupid. So are the pot laws.

It's very encouraging to see the states that are allowing people to use it for medical purposes, and it's even more encouraging to see states go recreational. I have not heard of anybody who's run into people [while driving], who's hit buildings or that kind of shit who's been high on pot and not booze, you know? I don't think I've heard anybody smoke a couple of doobs and go shoot up a grocery store. It doesn't work that way.

You were at the forefront of the counterculture in the '60s and '70s, and that really changed people's perceptions about cannabis at the time. Did you ever think that 40 or 50 years later, society would still be debating and even prohibiting marijuana?

No, it amazes me. How long does it take for people to say, "Oh, right, that could help"? There's so many things that this plant can be used for. It's really stupid. I never thought that would happen. But at the time, we'd just pass the joints around. It's just the way that was. So, for us, it wasn't like a big taboo.

What are your thoughts on the current administration? Do you foresee a crackdown on the current cannabis industry?

Well, at one point or another they've all tried to crack down on it. It hasn't gone far. Given what's going on in our government, I've said to friends in



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THE HIGH TIMES INTERVIEW

Fonda vaping in his latest film, *Boundaries*



Canada and friends along the West Coast here, “Look, let’s secede and join Canada.” We’ll make a deal with Mexico that we can also take Baja California, because there’s no manufacturing going on over there, and it’ll be a territory, but British Columbia, Washington, Oregon, California, Baja California should become “Baja Canada” [laughs]. It’d be great.

You could be the ambassador.

[Laughs] It’s not going to happen, but we’re the sixth-largest economy right here in California, and with the money we’ll make growing pot, for all of its uses... And of course, there’s the medical side. [Children] going through a hundred seizures a day, epileptic seizures. They give them the oil, [the seizures] drop to two or three immediately. How much proof do you need? You know? This is good. Let us have it. Let us grow it. Let us produce medicine. If people want to get high, go for it. You know, tax it. It’s a huge moneymaker. But oh my God, Big Pharma doesn’t want you to buy CBD oil to take the pain away, take the seizures away. They want to sell you a \$1,000-a-pill drug. It’s insane.

You’ve been outspoken about protecting the environment, and obviously, you’re a supporter of hemp. Do you think that activism still has the power to effect change, given Scott Pruitt and the state of the EPA?

Oh, absolutely. I mean, he’s not going to last that long. He lit his own fuse. He just didn’t know it. It’s creeping close up to his ass real quick. You can look at what can happen with demonstrations for a cause. Look at all those kids from Parkland and what they started. And now the grown-ups can’t stop it. You know? There’s a great riff from Bob Dylan: “Come mothers and fathers

throughout the land / And don’t criticize what you can’t understand.”

You can do so much good for the environment: not killing trees, not making paper in the paper mills, not spewing poison in the air. It’s a totally recyclable situation. How can you miss? Of course, you’ve got a bunch of knuckleheads and yahoos running the public show. It’s just so inane that hemp, which could be so helpful, is outlawed.

What’s your personal experience with cannabis? Did you discover it at an early age?

No. I wish I had. It could have taken the edges off a lot of bad situations. But no, I was in London in ’62, ’63 filming, and one of the cast members came up to me, “Hey, Fonda, we’re getting some tea in here. Want some?” I said, “Tea?” “Yeah, you know, we’re doing some grass.” I said, “Grass?” I knew nothing. “Well, you want some?” I’m not going to seem like I don’t know what the fuck’s going on, so I said, “Yeah, sure.” “Okay, when we get back to the hotel, give me a call.” So I got back there and I called this guy up and he said, “All right, come down and just knock three times on this door.” I went down. I knocked on the door and this fella came out. He hands me an envelope, and he says, “Okay, you’re going to have to clean it.” And I said, “Clean it?” “Yeah, you know, get the stems and seeds out...” “Oh, far out, okay.” I had no idea [laughs]. So that was when I was first turned on. I got a little miniature kind of souvenir corn cob pipe and puffed on it, and, man, I’ll tell you, I got to be so hungry. I ate everything on the menu in room service. I was such a skinny guy. I thought, “God, this is great. Maybe I could put some weight on.” I thought, “This is amazing!” I was laughing. I like to laugh. That’s good medicine.

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That was my first time, and it was hysterical and it's been fun. I don't go out and do a lot of stuff in public, and I don't try to flaunt it. It's there.

You started onstage in Omaha, right?

Yeah, in fact, I began working on the same boards, the exact same boards my father walked on when he started. That community playhouse was exactly where it was in the early 1900s.

And Marlon Brando as well, right?

Exactly. It was Marlon's mother that got my father onstage. My father was pretty darn shy, but she convinced him to read for this part. He'd been down there painting sets. He was good at that. He could paint a door on a flat that people would try to open. He was just one of those perfectionists in his drawing. He was a great painter. So he walked onstage at the behest of Do Brando. Her name was Dorothy, but we all called her Do. And Marlon I knew as Bud, because a junior in the Midwest is always Bud. So he was Bud Brando. And yeah, his mom got my dad onstage. He loved it.

Was your father accepting of the countercultural direction that you and Jane took?

Well, eventually he had to be, you know?

Terry Southern had a long history with *High Times* as a contributor. What was it like writing *Easy Rider* with him?

It was quite a wonderful experience. It's some special stuff. I was making a film on the west coast of France and waiting to work, and I heard this *cough, cough, cough*, and I hear this shuffling up the stairs and it's Terry. I told him the story of *Easy Rider* and he said, "That's the most commercial story I've ever

heard. What do you want to do?" I said, "Well, we want to put it into script form, but we don't have time to do it." He said, "I'm your man." And he was. It was just great. He gave us the title *Easy Rider*. We didn't have a title. But yeah, that's how we started rolling with Terry. I flew Dennis [Hopper] into New York, and we all met together and got the story straight. It was me who was telling the story all the time. I could tell the story to a wall and do it in detail with great passion, but that's how we got the money from Bert Schneider. I told him the story. There wasn't anything written down. It was fun and Terry was great. He was a good add, and think about the seriousness of having his name on the writing credits. I was very pleased and very proud to have him on board with us.

It's like the counterculture dream team with you, Terry and, of course, Dennis Hopper.

[Laughs] Absolutely!

A few years back, *Easy Rider* was voted the No. 1 drug film of all time by *High Times*. Do you necessarily see it as a drug film?

No, no. That was just what we were doing, you know. It's what was happening at the moment. The first score we made, we didn't see what it was. It was just a white substance, because I wanted to disturb whatever moral idiots were out there. Moral idiots would say, "Oh my God, they're doing *this!*" Well, too bad. This is what we're doing.

And in *Boundaries*, there's quite a bit of pot peddling...

Yes, Christopher Plummer's character has been thrown out of his senior-living facility for offering people pot. On the road, he's got to hide his pot in diaper bags. It was a lot of fun, and I'm glad to see it's going out and getting life, because people laugh with it. They're laughing. They're engaged. We need to laugh more. ✨

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Glass jars are a must for proper curing and storage.



SUBJECT: **Drying and Curing**

FROM: **Scott H.**

Hi, I read somewhere that when drying buds you should make sure that the outside is dry, but that the buds should still be somewhat damp in the middle. After the drying process is complete, you can then begin the curing process. So my question is: How long should I leave my plants up to dry without it ruining them? Lastly, what is the purpose and method for curing your buds?

Dear Scott,

It's true that when drying you want the outside of the buds to be dry. It's also true that there will still be moisture within the buds that you need to remove through curing. Here are the two steps of harvesting:

Dry your plants hanging upside down in a cool, dark place with plenty of air circulation. Within 7-10 days, they should feel dry on the outside and the stems will snap and break instead of bending. At this point, remove the

buds from the stems and put them into glass jars for curing. Open the jars daily to release built-up moisture as the water "sweats" out of the middle of the buds.

The purpose of curing is to smooth out the taste and burnability of your flowers. Uncured buds taste harsh and "green" and don't burn properly to a clean white ash. Well-cured nugs develop subtle scents and flavors and are a much more pleasant experience to smoke or vaporize.

Danko Tip: Mist your plants with a foliar feeding solution about a half-hour before your lights come on to avoid burning leaves.



Properly pruned plants produce substantially higher yields.

SUBJECT: **To Prune or Not to Prune**

FROM: **JayBird**

🌱 I have one plant and she's doing great! I must be doing something right. My question is this: Do I need to pinch back my plant? My husband keeps saying so, but I've told him to leave it be or else! The plant is just shy of 12 inches tall and was started outside, but it's a houseplant now. I plan on starting the 12-hour light/dark phase, so any advice is greatly appreciated.

Dear JayBird,
Pruning or pinching regimens are utilized by some growers in order to increase the number of tops on their plants. Cannabis naturally wants to grow in a Christmas-tree shape with one main cola dominant. When that main top is removed, several other branches take on the dominant role and the plant takes on a bushier profile.

This type of action should be taken early during the vegetative period and not close to when you induce flowering.

When plants are pruned or topped early, they still have time to recover and build big branches. When they're topped just prior to or during flowering, yield is greatly reduced because the plant hasn't bounced back and grown strong yet.

An even better option in the later stage of vegging is to weigh down the dominant cola with a fishing weight on a line. Any bending technique should work, but you must be gentle and careful not to break the branch. The idea is to get the top branch to hang below some of the lower branches. The plant will send hormones called auxins to change the growth pattern, thinking that the dominant branch has been cut, even though it hasn't been! This results in better production without actually removing any branches growing on your plant.

Lower leaves and branches can be removed if you determine that they are shaded out and won't be productive. Yellow leaves and dying branches should always be removed to avoid creating a home for pests and diseases.

SUBJECT: **Flowering Time**

FROM: **Mikey B.**

🌱 When do you start counting flowering time? Does it start when you change the hours of light or when the plants start showing flowers?

Dear Mikey,
Flowering time is measured from the day you change the lighting cycle to 12 hours on/12 hours off. Most strains won't begin showing flowers until a week or two into the flowering stage. Therefore a 60-day flowering strain should be ready to harvest around 8½ weeks after the day you changed your light cycle.

SUBJECT: **Slow Growth**

FROM: **Adam B.**

🌱 I'm about four weeks into the vegetative stage in my current grow, and I'm faced with two stunted stragglers. I planted two in my traditional mix and, against my



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DEAR DANKO

Danko Tip: Never let soil containers sit in stagnant water. Drain runoff water from your overflow trays within an hour of watering.

better judgement, two in a compost mix that my friend suggested I use. I knew it was a bad idea, but he has a BA from WSU and assured me it would not be too hot of a mix and the plants should like it. Wrong.

As expected, after a week in the compost they had hardly matured, while my traditional-soil plant was thriving (the other did not survive transplant—I'm 99 percent sure it was my fault). At two weeks, I ditched the compost and repotted the plants into my regular soil. It has now been another two weeks and I am desperate to go into flower for my lead plant, but these two are still straggling. They're nice and green with more and more sets of leaves developing, but they're still seedling diameter and 6-8 inches tall. Is there anything I can do to help them along or is it just a waiting game?

Dear Adam,

Your best bet is to prune or train your larger plant to be a bit smaller while your smaller plants continue to grow and build up leaves and branches. Otherwise, you'll get a fairly small yield from your stragglers. Also, be sure to raise the smaller plants closer to the light so they're not stretching to reach the height of your larger one.

SUBJECT: **Flower Forcing**

FROM: **Smot Poker**

🌱 I live in an area that usually gets its first frost around late September. I have a plant growing that takes 70-75 days to harvest, and I was wondering if it's possible to induce flowering early on an outdoor plant. If so, what would the outcome be?

Dear Smot,

Yes, it is possible to do, but it will require a bit of work on your part. You're going to be utilizing a process called light deprivation during the earliest part of your flowering period. Outdoor plants don't tend to start flowering until around early August on average, but you'll be using light deprivation to start this process in June or July.

You will be reducing the amount of light that your plant gets per day, and this will require some sort of dark opaque covering. It can be as simple as an individual tent that you place over the plant or a greenhouse with a dark-colored tarp that goes over it. I've even seen these with solar-operated winches and timers so you don't actually have to manually cover the plant every day.

Starting in July, deprive the plant of any light more than 12 hours per day, every day, and you'll see flowers forming before the end of the month. When late August rolls around and the natural light has reduced to 12 or less hours per day, discontinue the light-deprivation process. You now have a plant that's been flowering for a month already and will easily finish before any frost comes around.

You could also extend the season beyond the frost by using a greenhouse and keeping the plant warm with a heater. This requires a bit more room and isn't really feasible for just one plant. I've seen heated greenhouses in Maine growing tropical fruits in December.



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DEAR DANKO

Danko Tip: Use a sharp razor blade to cut clones; scissors or serrated knives will damage the cut end.



Air-cooled lighting reduces heat stress significantly.

SUBJECT: **Heat Stress**

FROM: **Weednerd247365**

Hi, I have some plants in flowering. I'm in week four now and I noticed seeds starting to form—not a lot, just a few. The plants are five and six feet tall. In all, three of my plants have started to seed. But all the other plants have no seeds nor any signs of seeds (yet)! I'm wondering if heat stress caused the three plants to go hermi (it's spring now, but not yet warm enough to run my air-conditioning unit). The temperature in the bloom room is 85°F right now. My other variable, though, is that the plants were root-bound and then transplanted into 30-gallon containers from 5-gallon ones. They did have to recover from that before flowering. Could it be a combo of both and just too much stress, or do you have any other ideas? Also, the strains are females. I've grown one previously, and the others are from Northern California. I'm in the Upper Peninsula in Michigan.

Dear Weednerd,

If you're noticing seeds forming in week 4 of flowering, you're in for many more as you continue. One or more of your plants have turned hermaphroditic, most likely due to the stress of heat and being root-bound, as you surmised. My advice is to either finish up your flowering stage as usual or get rid of the hermaphroditic plants and start over. If you finish them out, you can pick out the seeds or make hash with the plants, but, in my opinion, seeded buds aren't very fun to deal with, so consider a restart if you're not too attached to them. 🌿

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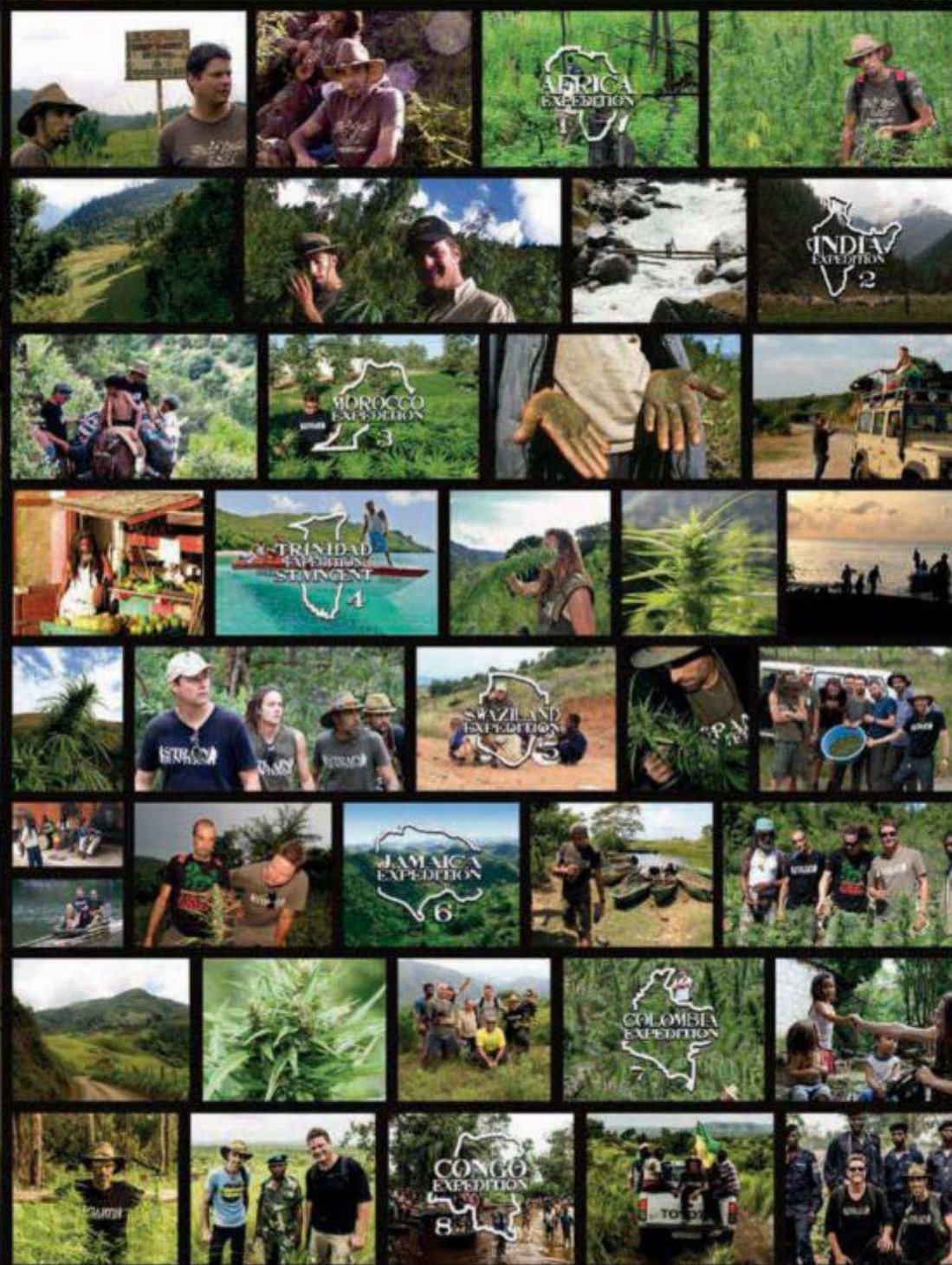
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2 FILTER IT OUT

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canfilters.com

Growers know the importance of filtering odors from expelled air, but the costs and sizes of some previously available units could be daunting. The new Can-Lite Filters from Can-Filters are available in nine sizes, from four to 14 inches with airflow from 250 to 3,000 cubic feet per minute. The Can-Lite's lightweight aluminum housing and built-in flange make it easy to install, and the low-density Australian granulated carbon scrubs your air clean.

3 LIGHT RIGHT

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4 MIX LIKE A PRO

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pthorticulture.com

Overwatering runs rampant in many indoor pot farms, and it can have devastating effects on plant health and overall yields. Roots that stay wet for long periods of time are subject to mold and rot. Avoid overwatering by using Pro-Mix HP as your growing medium. The high perlite content ensures proper drainage and the wet/dry cycle that marijuana plants prefer. The added bio-fungicide and mycorrhizae protect your roots and encourage healthy growth.

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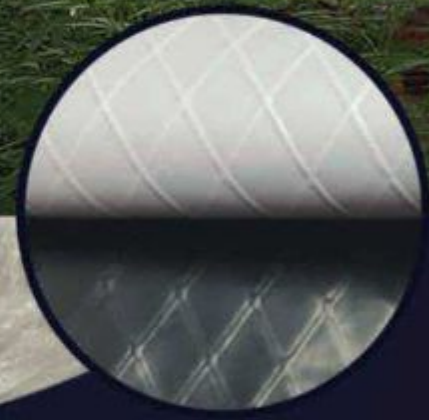
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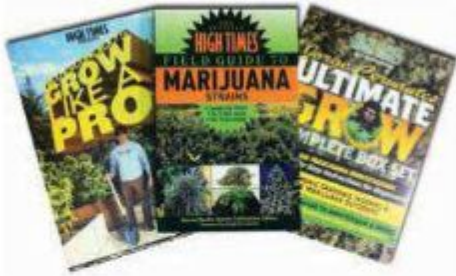
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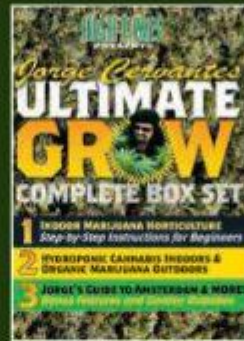


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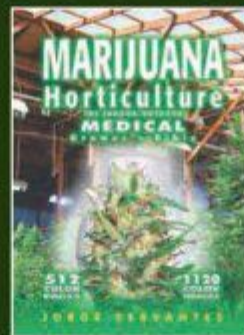


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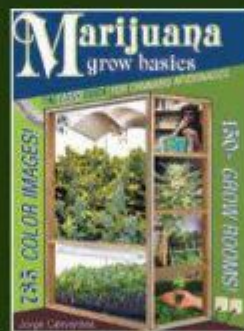
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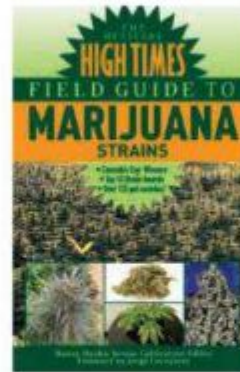


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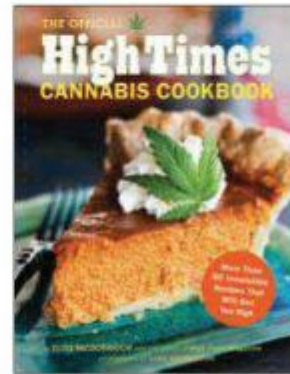


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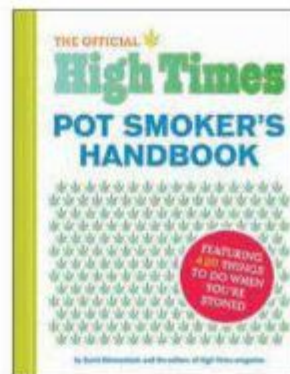
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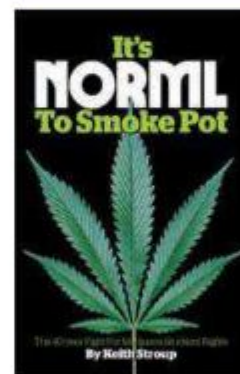
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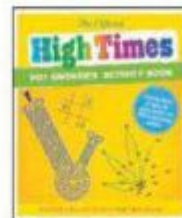
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MARIJUANA MARGARITAS

THE LAZY DAYS OF SUMMER JUST GOT A WHOLE LOT MORE RELAXING THANKS TO THIS REFRESHING LIBATION. *BY JOANNA O'BOYLE*

SOMETIMES YOU WANT an easy, icy, DIY drink infused with cannabis, but you haven't made any cannabis-infused alcohol ahead of time (because it takes weeks, and it involves straining—a step I'd rather skip entirely). Here's an alternative method to infuse juice with cannabis concentrate in a no-fuss, no-alcohol, 20-minute recipe.

The key to this recipe is the liquid sunflower lecithin, which acts as an emulsifier and suspends the extract oil in liquids, without the need for a solvent like alcohol. The essential orange oil and the cannabis replace the triple sec and tequila found in a traditional margarita, and when combined with the intense lime-juice concentrate and served in a salt-rimmed glass, the resulting zing of bright citrus with salt is like sunshine and sea air. It's summer in a glass! ✨

INGREDIENTS

1 gram high-quality cannabis concentrate*
5 drops orange-oil extract
1 gram (about 2 tsp.) liquid sunflower lecithin (found in health-food stores)
2 cups or more of vegetable oil (for the oil bath)
12 oz. frozen limeade
1 cup filtered water
2 cups ice cubes
Kosher salt (to rim the glasses)

DIRECTIONS

Pour the oil into a saucepan, enough for a small glass bowl placed in the center to be halfway immersed. Heat the oil to a steady 275°F, using a candy thermometer to monitor the temperature. Place the cannabis concentrate in a small glass bowl, then carefully place the bowl into the oil bath in the saucepan. Continually stir the cannabis extract as it warms in order to evenly decarboxylate the oil, as the sides of the glass will be hotter than the center of the concentrate. Heat and stir until the bubbles have stopped their "maximum peak formation" (i.e., when bubbling activity slows visibly), which takes about 10 minutes. Remove the glass bowl from the oil bath carefully, using a pot-holder. Wipe the oil off the outside of the glass as you pull it from the bath.

Add an equal amount of liquid sunflower lecithin to the still-warm oil in the glass (about two teaspoons), along with the drops of orange oil. Stir thoroughly. The mixture will foam slightly as the lecithin breaks down the oils before clarifying into an amber liquid. Combine the concentrate liquid with the frozen limeade in a blender, then slowly add two cups of ice (one to two cubes at a time) while continuing to blend until smooth.

Salt the rims of margarita glasses, then pour. Finish with a fruit garnish and *voilà*—an icy, cannabis-infused twist on a classic adult beverage.

**The potency of your drinks will depend on the strength of your cannabis concentrate. I used one gram of 80 percent THC concentrate and ended up with about 110 milligrams of THC per drink. The recipe makes seven six-ounce beverages.*

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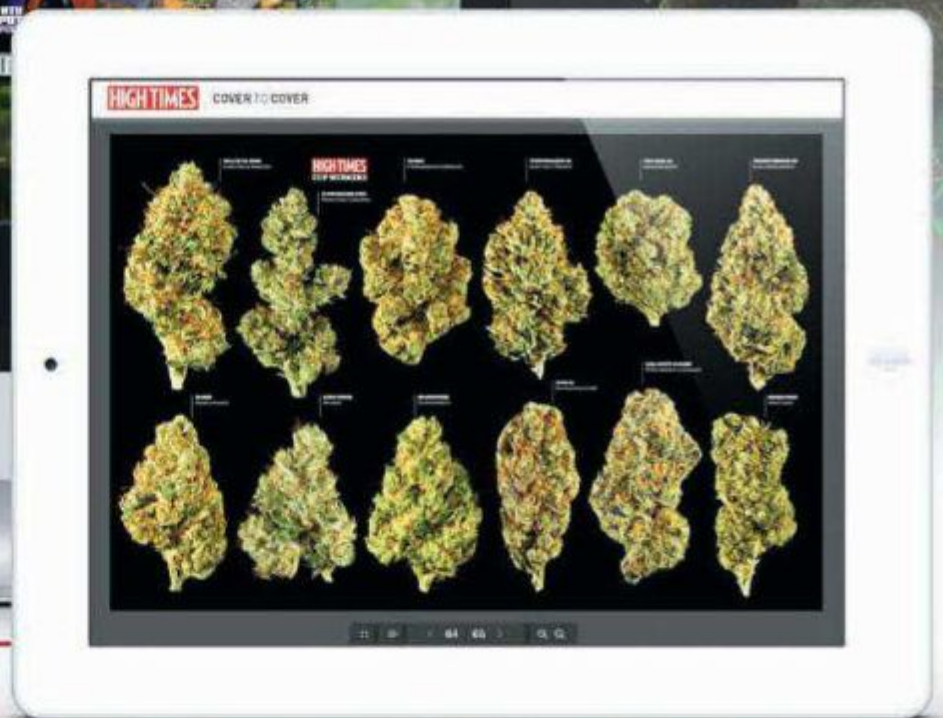
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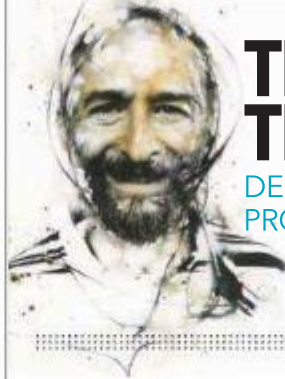
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Got a question for Dr. Mitch? Email him at 420research@gmail.com.

Cops claim that decriminalization doesn't do anything but lead teens to pot. Help!

Rick Sanatorium

Hi Rick,
My buddy Rick Grucza looked at data from Massachusetts, Connecticut, Rhode Island, Vermont and Maryland. He found a significant decrease in drug arrests and no increase in teen use. Decriminalization is clearly a good thing.

Do you think I could add hemp protein to my gluten-free bread recipe?

D. Baker

Hey D,
Researchers in Poland showed that substituting 20 percent of the starch in a recipe with hemp protein made gluten-free bread more nutritious without messing up the structure of the dough. So bake on!

Last month you revealed that the Chinese Emperor Shen Nung, who I thought discovered cannabis, wasn't real. What's the deal with this mythical marijuana figure?

N.O. Santa

Howdy Santa,
Once we go back five millennia, history gets a little tough to figure out. One prominent guy seemed to know a lot about agriculture and medicinal herbs somewhere around 2800 BC. He gets credit for cannabis, black tea and *ma huang* (the plant form of the methamphetamine precursor ephedrine). Legends



developed around him, much like our stories of George Washington and a cherry tree, and the mythological figure of Shen Nung was born.

Can CBD really help prevent relapses for drug problems?

Hope Enpray

Hello Hope,
Animal research confirms that CBD helps anxiety in general while preventing alcohol-dependent rats from running back to the booze when they were stressed out or around alcohol triggers. These are some of the most promising results we've seen in a while.

Can cannabis really make opiates work better?

Pained & Confused

P&D,
My friend Gill Bedi showed that a low dose of oxycodone worked significantly better after a couple of puffs of the plant. Everybody's pain is different, of course, but controlled lab experiments like these are very compelling. 🌿

Dr. Mitch Earleywine, PhD, is the author of Understanding Marijuana and The Parents' Guide to Marijuana.

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4.8kg/10.5lbs



THE FAQs ABOUT CANNABIS

HOW TO GET YOUR PARENTS AND GRANDPARENTS TO GO NORML.

Jamie Lescht is NORML Junior Associate. Visit norml.org.

Support the legalization effort by speaking with your folks about pot.



I F YOU ASKED me six years ago if I thought I'd ever be working for a cannabis-advocacy firm or if my parents would be accepting of that career path, the answers to both questions would have been a resounding no. Being a woman from a white, upper-class family, I too fell victim to anti-marijuana propaganda.

Luckily for me, my family has made the effort to reconsider their understanding of cannabis. And, through my role at NORML, I have improved my ability to articulate the benefits of marijuana legalization. But in conversations with people from older demographics, I have found that our country's reefer madness is deeply ingrained and has largely influenced their attitude toward marijuana-law reform.

It's no secret that older generations typically have a higher voter turnout than other age groups, and with the upcoming midterm elections, it's important to spread the word about the benefits of legalization. In order to continue changing perceptions and laws, younger generations must be able to effectively communicate with seniors.

Here are the most common questions I receive about my work in the marijuana-law reform movement and my

IT'S NO SECRET THAT OLDER GENERATIONS TYPICALLY HAVE A HIGHER VOTER TURNOUT THAN OTHER AGE GROUPS, AND WITH THE UPCOMING MIDTERM ELECTIONS, IT'S IMPORTANT TO SPREAD THE WORD ABOUT THE BENEFITS OF LEGALIZATION.

responses, which might prove helpful to those still trying to find their voice in support of cannabis.

Why are you so passionate about marijuana legalization—do you love getting high that much?

My greatest problem with this question is that it ignores the fact that being pro-cannabis-reform doesn't mean being pro-smoking or being pro-intoxication. Supporting the legalization agenda can mean everything from being against wasting billions of dollars on the government's failed War on Drugs to opposing the systematic racism that leads to disproportionate arrests of minorities for minor marijuana offenses.

I am passionate about marijuana legalization because it is preposterous to believe that America will ever be a

drug-free society and by legally regulating a cannabis market, it makes it harder for minors to possess marijuana, helps eradicate the illegal drug trade and disposes of a policy that has done more harm than good for the country.

Are you not afraid of backlash from employers who find out that you support marijuana?

Simply put, my answer to this question is no. Supporting the legalization of cannabis is a common-sense policy. Legally consuming while off the job does not warrant discriminatory employment practices. Several states have already put in place legislation to protect employees from workplace prejudice. Smoking a joint after work should be regulated no differently than having a glass of wine at the end of the day.

Are you able to be friends with people who don't smoke marijuana?

Come on! We've all heard the saying "Treat people how you want to be treated," and the same mentality applies to cannabis. My closest friends do not smoke marijuana, but they are fervent supporters of cannabis legalization. They support the movement for all the same reasons I do, and I—as a good friend and respectful human being—would never pressure someone to do something that they do not feel comfortable doing.

In order to sustain the momentum of the cannabis movement, it is imperative for diverse groups of individuals to engage in an open dialogue while acknowledging that all people bring something different to the table.

My answers to the above questions are based on my personal experience, but they could help some readers better articulate their stance on cannabis and marijuana-law reform when confronted by people with a negative opinion on pot—or those who are genuinely curious about cannabis. The important thing is that we use discourse as a platform to elevate the movement.

Find out more at norml.org. 🌿

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COMPLIANCE IS THE KEY TO LONGEVITY

Scott Holtby Is A Freelance Writer With A Pulse On Cannabis Industries.

Over the last few years, we have seen an unprecedented push towards greater legalization of cannabis in a number of key markets, most notably in the U.S. and Canada. Unlike Canadian markets, pushed forward through federal support, U.S. legalization efforts have been driven by state legislation. This has led to a worry that the legal cannabis industry is in a "wild west" phase, crying out for greater regulation and enforcement.

Despite strong public support and a powerful movement of entrepreneurs and activists in key states like California and

Colorado, there remains heavy pushback from much of the public. For cannabis to fully integrate into the mainstream of American life, clearer rules and stronger enforcement surely will be necessary. In particular, this will likely be a key part of the inevitable federal legalization of cannabis. State governments from both sides of the political spectrum in the United States are leaning consistently in favor of greater cannabis legalization. This is a common theme from both Americans concerned with freedom from government control, to Americans concerned about unevenly-

enforced drug laws that unfairly target minorities.

This consensus is steadily increasing day-by-day, but the final hurdle will involve skeptics concerned about public health and child safety.

In order to satisfy the demands of a concerned public that represents a large portion of the American population, it is inevitable that cannabis will see greater enforcement. This includes a long list of possible regulations. An example could be a law restricting dispensaries from operating within a given distance of a school or daycare.

Or a law capping the total volume of cannabis a customer can buy in a given timeframe.

Businesses currently operating legally at the state level need to be ready for a shift in cannabis regulation. So far, the Federal Government has stayed largely outside of legal cannabis at the state level, but there has never been a clear sign this would be the case forever. Should the Federal Government take a strong stance on cannabis, companies need to be ready to meet the scrutiny and necessary commitments that likely would be needed.

Companies already operating at a level of compliance and transparency are on the right track to ensuring their practices will fall in line with any eventual mandate set out by the Federal Government to regulate the cultivation, sale and distribution of cannabis.

Industry actors like *Alternate Health Corp.* (OTCQB:AHGIF) recognize this need to be prepared and are building compliance and transparency directly into their products and services. Companies also need to be prepared as governments and political parties change and electoral whims get passed into law. They need to recognize that regulators will have a wide range of flexibility on how they choose to enforce their mandate.

Therefore, cannabis companies need to prepare for government changes and protect themselves from risks in the future. And for investors, the key to longevity will be embracing the regulations of the marketplace.

AlternateHealth.com

Women In Cannabis



Gia Morón

Executive VP, Women Grow

▶▶ *Any advice for emerging female entrepreneurs in the Cannabis Industry?*

Come prepared to work hard. This is a unique space that is writing the rules as we grow - Most people entering are expecting the same support and guidelines as other industries, but the industry is not there yet, so if you have the expertise, bring it, because it is needed. This is a wonderful opportunity to be a part of an industry, where you can contribute to building. Come with an open mind and flexible shoes ready to pivot at any moment. This

is an exciting time to work with thought leaders and game changers. Ladies, network constantly, join cannabis member organizations where for profit or not profit. Those circles are important. Stay up to day on the news in the industry; subscribe to magazines like High Times and most importantly find a mentor in this space. Create a circle of contacts you can build relationships with.

Lastly, begin to learn the businesses in this industry. It will help guide you in the direction you will want to land.

▶▶ *What is the biggest trend in the cannabis space right now?*

It depends on location. What jumps out most are the ancillary services coming to market. These businesses are coming up with creative solutions to support businesses and consumers. From convenience to luxury services whether door to door service to 420 friendly mobile vehicles for safe and easy consumption I am seeing more family owned businesses entering this space; Old school practices meets legal industry. More college students

Continued ... ▶▶



NEW OPPORTUNITIES ARISE IN CANNABIS COMPLIANCE

Nick Swan is an avid investor and advocate for Medical Cannabis Industries

The shift to legalized medicinal and recreational marijuana is underway in many states and this process is opening up new opportunities in regulation and compliance. Public concerns about age verification, child-proof packaging and impaired driving in particular are capturing the attention of businesses and the public alike.

Although the issue of impaired driving is nothing new, legal cannabis is pushing this debate to the forefront of the public conversation. More attention has been placed on how to monitor, test and control cannabis to ensure no one operates a vehicle under the influence.

Concepts affiliated with controlled substance legislation, like road side testing, childproof packaging, and age verification already have obvious precedents in other markets.

Alcohol, tobacco and prescription medications have long-established guidelines and regulations in place.

The cannabis industry is adapting these models to address public concern, but each model must be redesigned to fit this unique industry. Packaging must address deterioration of the product; age verification online will have to be addressed and a new technology for roadside testing will need to be developed to close all the existing gaps in compliance.

A system that provides a fool-proof method of age verification, especially online, is needed to address the concerns regulators have of cannabis falling into the hands of underage consumers.

That's why companies like *Alternate Health Corp.* (OTCQB:AHGIF) have a built-in application for age verification through their *CanaPass* Compliance Blockchain System that ensures the person who places and receives the order is of legal age.

Like many medications, a child-proof container for cannabis is another step towards safety. However, there are other considerations to be taken into account

that are specific to cannabis in terms of packaging and maintaining the quality of the product within. Over time, the deterioration of an organic compound like cannabis must be considered in packaging. Companies like *eBottles.com* and *Kush Bottles* are already moving into this space, developing custom products for the legal cannabis industry.

There is no technology that mirrors a breathalyzer for detecting cannabis impairment. This concerns regulators and has sparked a race among companies to develop the technology and become the standard in this space. *Hound Labs*, for example has developed a handheld device similar to a breathalyzer that has reached the stage of clinical trials.

In the regulated legal cannabis market, compliance will be key. Companies that are working with governments and regulators to ensure that cannabis is always consumed in a safe and legal manner are the ones that will survive in this industry.

AlternateHealth.com

are looking at cannabis as a serious career path where they can build the next solution. I see rising trends in cannabis-infused feminine products. Women in general are interested to learn how such products could support needs from chronic pain to intimacy accessories. This is a big deal for women of a certain age seeking for solutions as their bodies are changing. Anyone in the cannabis, intimacy and feminine-product space are geniuses, addressing a large pool looking to support them.

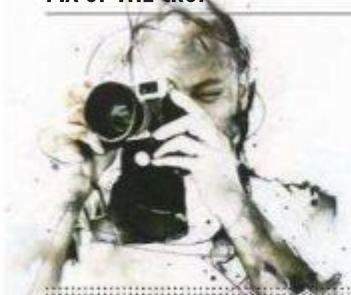
▶▶ **How is Women Grow adapting to rapid industry fluctuations?**

When the company first launched the focus was female entrepreneurs. In the beginning the company grew fast and we scaled back. Also there was a shift we were beginning to see more female professionals less interested in launching a business, but instead wanted to work for a business in a leadership capacity. Our goal is to remain tapped into both the women business owners and c-suite professionals, along with advocacy leaders.

Our roles are important and must remain connected. We are eager to work with women at all levels of their careers. Those who are familiar with the Women Grow

model know we have markets (formerly known as "chapters") across the country and Canada. We are preparing for growth again but at gradual pace. We are currently making changes to our Market Leaders program. Our goal is to increase education to keep up with industry growth, connect with the next generation of women leaders who are currently exploring this industry - tapping the graduate level scholars for education and opportunities in cannabis and some other soon-to-be-announced projects. *Women Grow* is preparing for its greater footprint in the market now. We see a bright future for our company.

Connect with : womengrow.com



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FLOWER OF THE MONTH

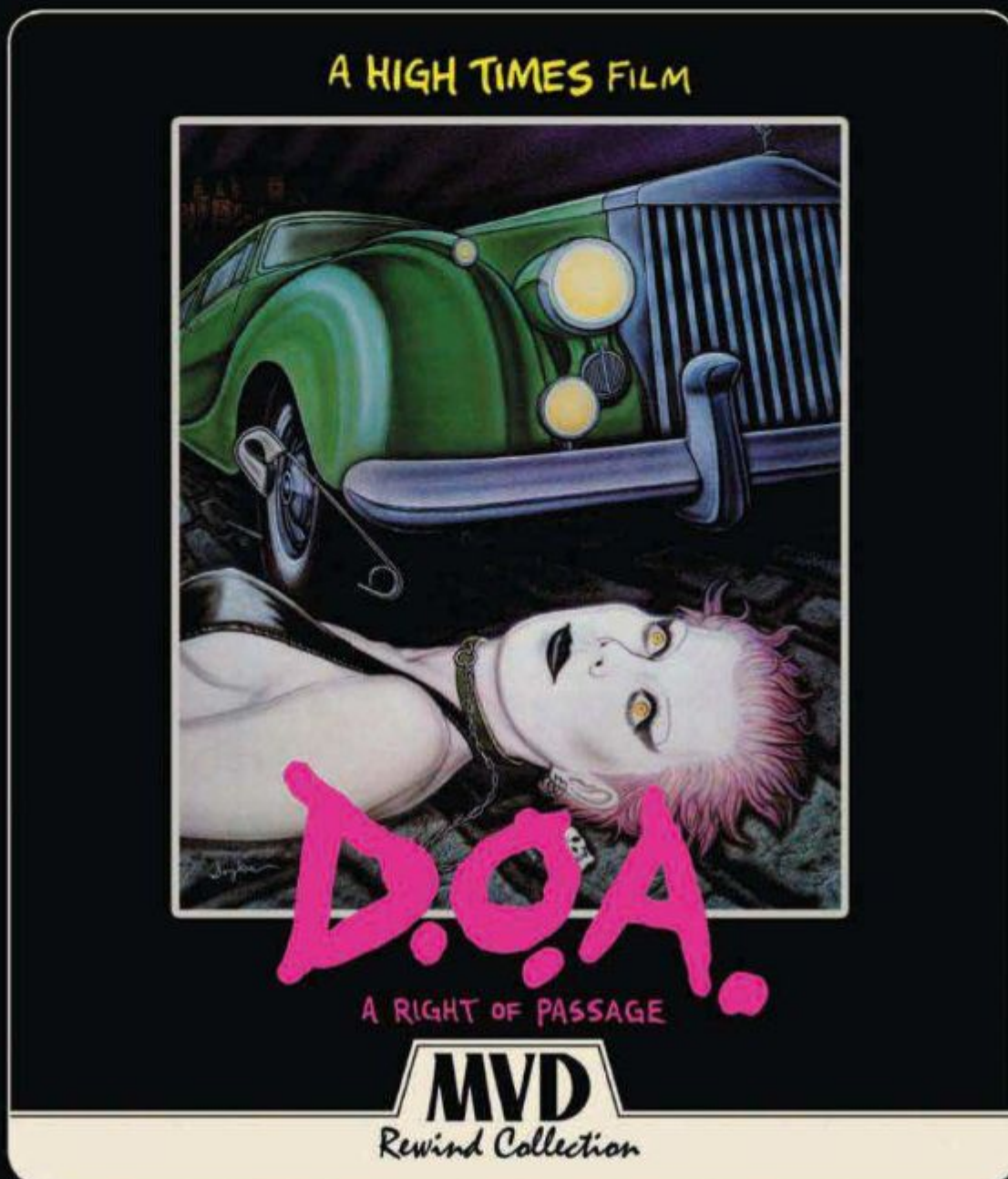


SUNNY DAZE

I'm almost 21, I've been growing longer than I've been smoking, and I've had my medical marijuana card four years now. I'm growing on a 14-acre plot in SW CO. My father died when I was three building our home so I'm growing to finish his work. *Jake K*

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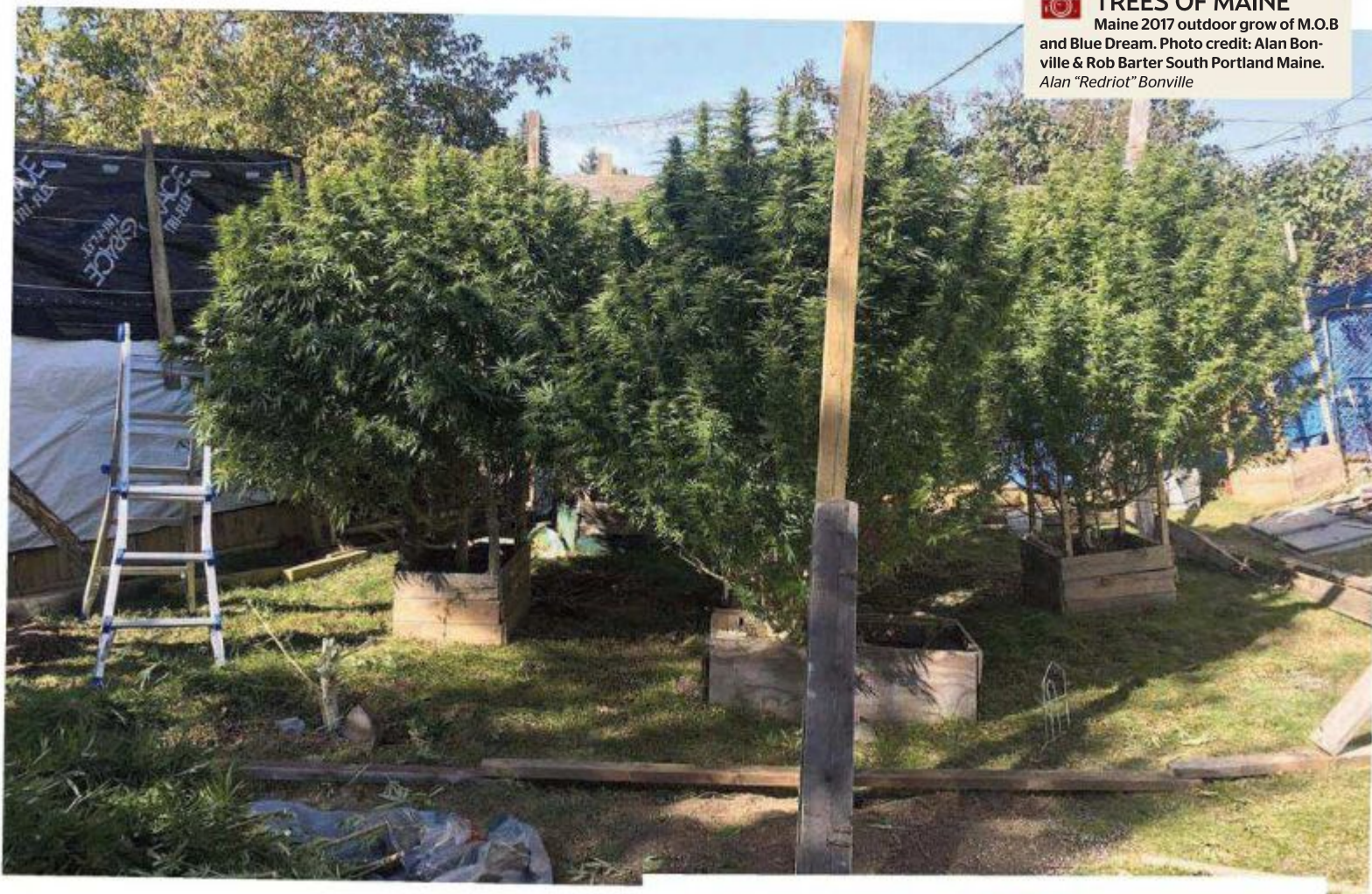
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TREES OF MAINE

Maine 2017 outdoor grow of M.O.B and Blue Dream. Photo credit: Alan Bonville & Rob Barter South Portland Maine. Alan "Redriot" Bonville



CRITTER OF THE MONTH

THE CAT'S MEOW

Our furry feline friend loves the smell of freshly grown buds a little too much. Ozzy Pawsborn

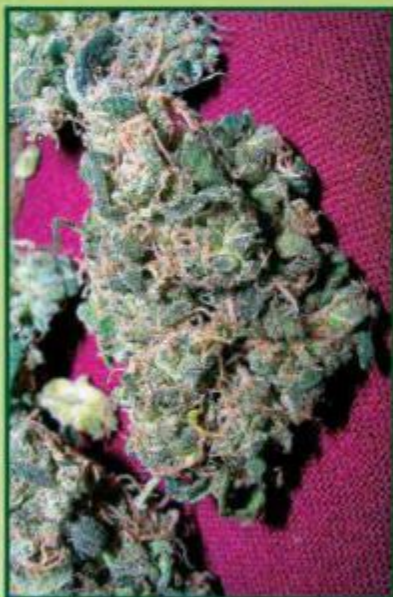


CLOSE UP OF THE MONTH

MA-HIGH-LO

Ocean Grown Seeds's Ninja Fruit, grown organically with Nectar for the Gods in Puna, Hawaii under a single CMH (ceramic metal halide). Six9genetixx

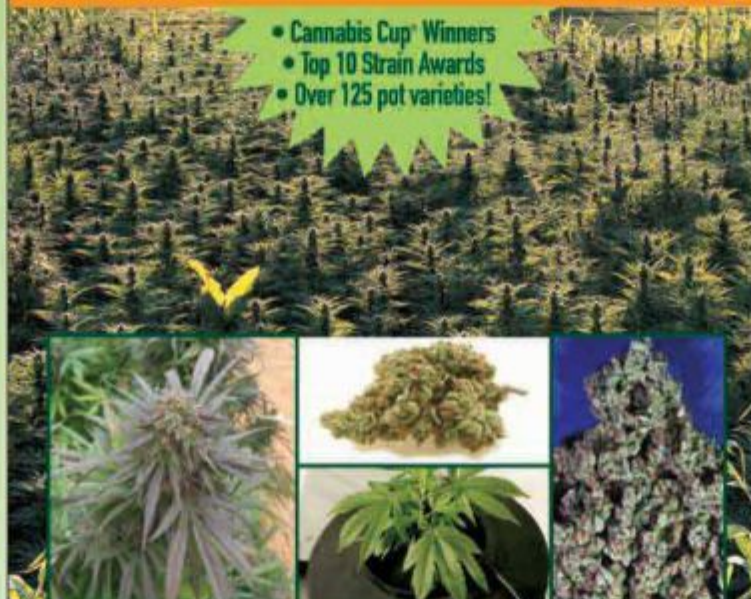
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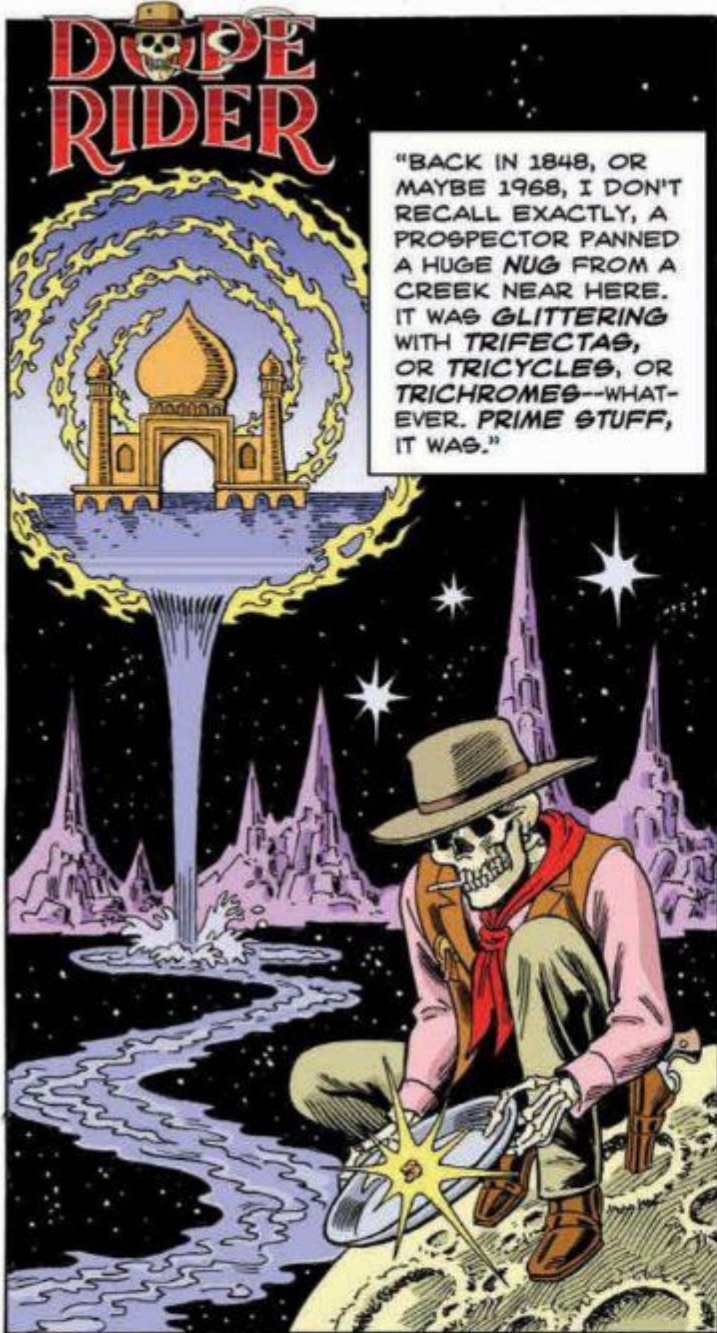
Effects: Relaxing, euphoric, and slightly sedating

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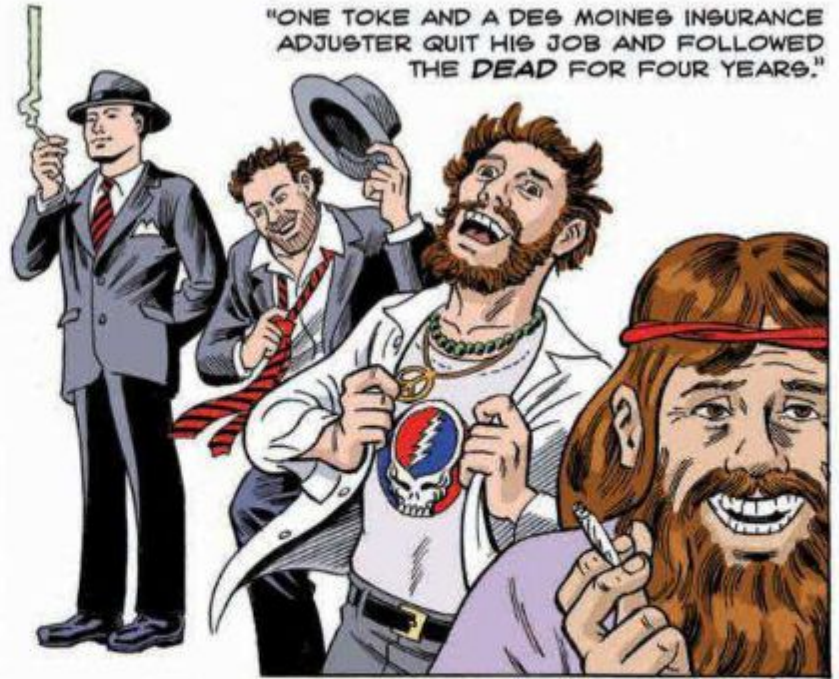


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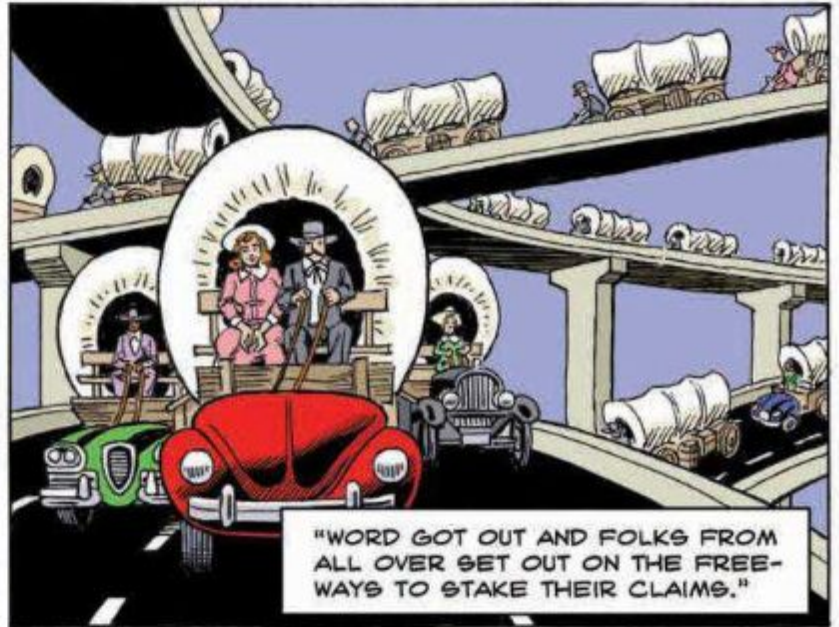
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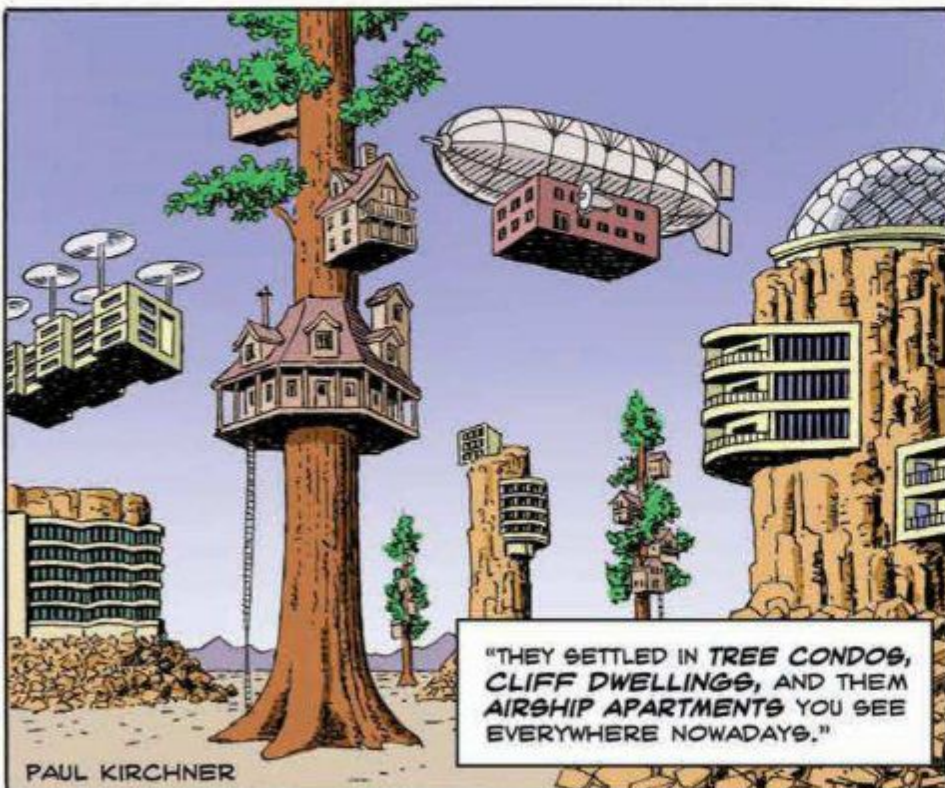
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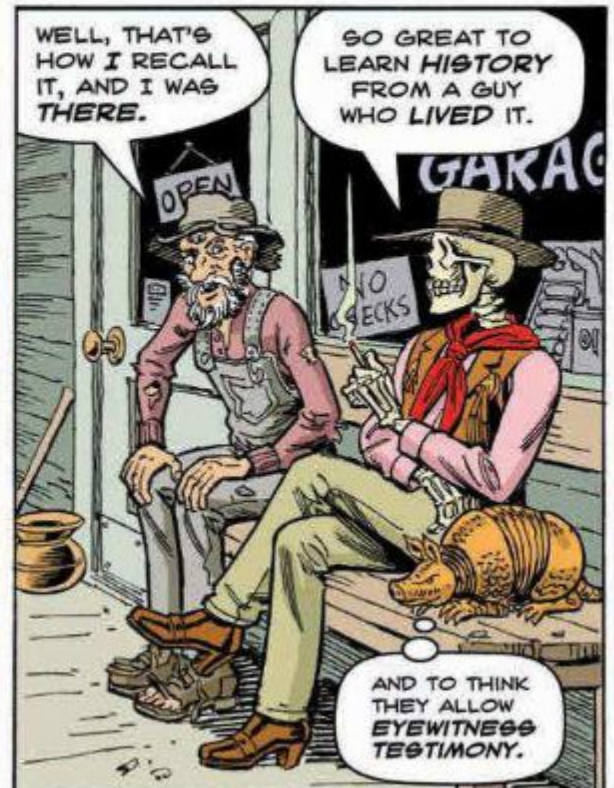


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How Select became the best-selling cannabis brand on the West Coast

Photography: Tyler Lyon

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Because of that, Select is now the best-selling cannabis brand on the West Coast. Here is what you should know about the Select brand:

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GROWING
EPOSED

THE GAME HAS CHANGED

Article by Jeremy Deichen

Beautiful buds ready for harvest

Growing Exposed, a new video series produced by Jeremy Deichen, has been coined "the MTV Cribs of the marijuana industry" for its exclusive look into the once underground world of North America's gardens. Aside from revealing secrets of industry leaders, David Robinson, author of *The Growers' Handbook*, lends his expertise to a segment called *Teachings of the Garden Sage*. You can check out gardens, like the ones that make British Columbia's Kootenay region the Mecca of B.C. bud, on the latest episodes at growingexposed.com.

When Bryan Johnston began growing cannabis, it was the early '90s. He was using 1000 watt bulbs hung from the ceiling commonly referred to as "Donkey Dick" lights. During this period, British Columbia was becoming infamous for the highest quality bud on the planet and people were calling the province's crops "Beaster". A lot has changed in the 25 years since — including his setup and the base plant food he uses, thanks to Green Planet Nutrients.

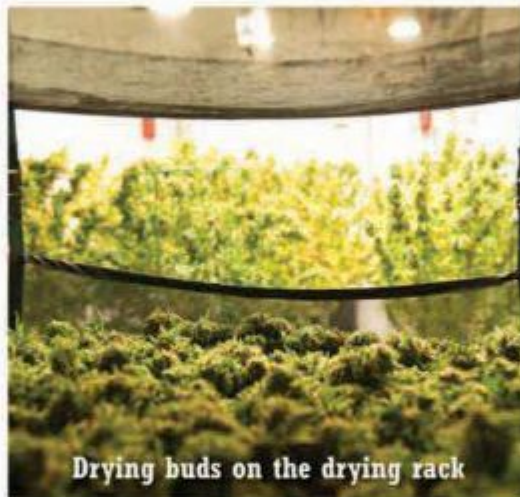
An environmentally conscious guy, Bryan says he remembers, back in the day running those 1000 kilowatt bare bulbs. Today, his indoor garden uses a smaller wattage but yields dramatically more per watt than ever before.

**"Everything has changed.
The game has changed,"**

he says. "I'm running doubled-ended P.L. lighting with four Spectrum King 600-watt LED lights and doing a massive cross spectrum of light, running four 315-watt P.L. ceramic metal halides. So I'm totaling just under 4,700 watts and yielding on average, two pounds or more for every 1,000 watts of light."

The most recent change to Bryan's garden wasn't in setup though, but to a new base plant food. Manufactured by Green Planet Nutrients, Dual Fuel is a highly concentrated, two-part formula that provides all the energy plants need without the need for calcium or magnesium additives. It's known for an easy application process which leaves less room for error.

"I've tried different brands but I've been using Green Planet's Hydro Fuel and got fantastic results, so when I went to my local grow shop and got some samples of Dual Fuel about two years ago, it wasn't a stretch to give it a try," Bryan says. "But on some level, any type of switch is a leap of faith as a grower. People who consume my product are used to a level of quality and I can't afford to give them anything less than the best."



Drying buds on the drying rack

Growing Lemon Haze since 2011, Bryan says this strain takes a little longer to flower than normal but the flavour and sativa experience is well worth it. He finds it easy to grow and the resulting product very consistent in quality. With the switch to Dual Fuel, Bryan says he noticed changes to his plants almost right away.

"The switch was really easy and the first noticeable difference was that my plants became way greener than before and they stayed lush green into the later stages of flower. It's also cleaner and I don't have salt residue or buildup. Plus I'm getting better and faster yields, so I'm saving about a week overall on my crop. I've done the math on what it costs to run other brands and not only am I saving money but I'm having better results."

With Dual Fuel, Bryan uses only three additives: Green Planet's Massive Bloom Formulation, Finisher, and Terpinator. He says when he's tested plants grown with the additives versus ones without, he's noticed way more cannabinoids.

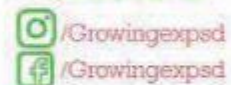
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